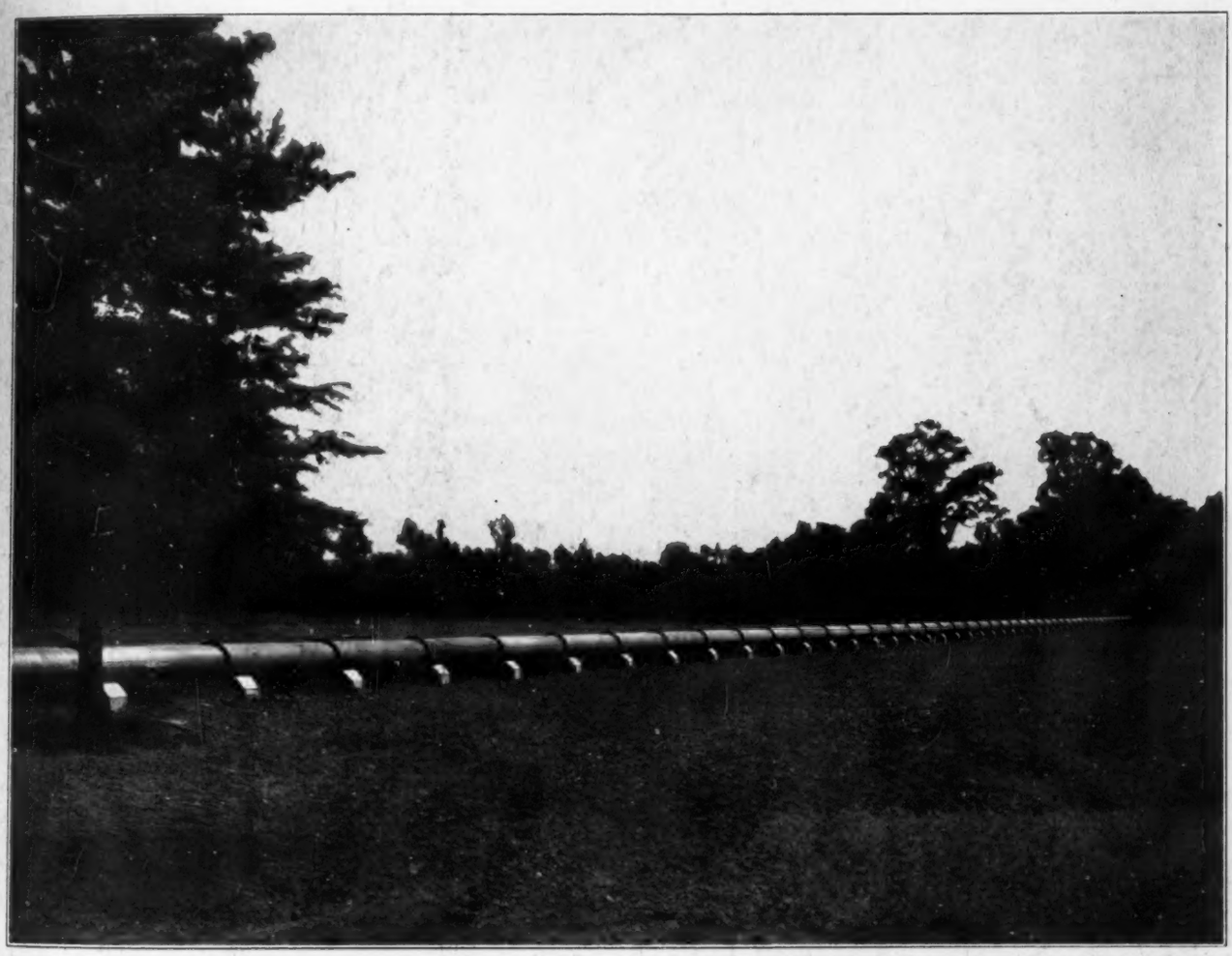
WATER WORKS AND SEWERAGE

October, 1935 — Editor — Vol. LXXXII. No. 10



One of Two 30-inch Cast Iron Trunk Sewers Constructed to Eliminate Infiltration and the Expense of Sewage Lifting at the New Treatment Works of Durham, N. C. (William M. Piatt, Designing Engineer)

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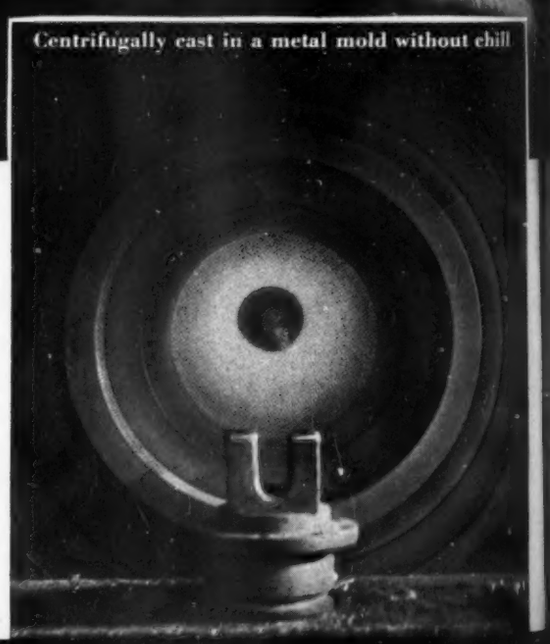
Blowing Out Service Lines
Corrosion Control with a Marble Filter
The New Sewage Treatment Plant of Walden, N. J.
Report of 54th Convention of the New England Water Works Association
Features of the New Northside Sewage Treatment Works of Durham, N. C.

IMPACT RESISTANCE DOUBLED!

Unloading 5500 feet of 16" Super-de Lavaud Pipe at Water Department stockyard for installation at Washington, D. C.



Centrifugally cast in a metal mold without chill

THE full span of a cast iron water main's useful life is yet to be measured: witness the fact that the first recorded installation of cast iron water pipe is still in use after nearly three centuries of service. Certain it is that Super-de Lavaud centrifugally-cast pipe with its notably improved metal structure will more than live up to cast iron's unique reputation for long life. This is a *stronger, tougher, more ductile* cast iron pipe, made so by a patented and proved process in which gray iron is centrifugally-cast in a metal mold *without chill.* Impact resistance is *doubled* without lowering tensile or bursting strength. Send for descriptive brochure.

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WATER WORKS & SEWERAGE

L. H. ENSLOW,
Editor

FUTURE ARTICLES to Appear in the Next and Subsequent Issues

"A New Method of Applying Copper Sulphate to Reservoirs"—is to be described by R. F. Goudey, Engr., in Charge of Water Quality, Los Angeles Water Department. The scheme involves the use of pulverized sulphate of copper and a broadcasting dry feeder located in the stern of the boat. The method has proved labor saving, more economical, uniform and effective than the bag or spray methods.

"Elements of Water and Sewage Works Meters": By L. D. Carlyon, M. E., Bailey Meter Company, Cleveland, O., constitutes a discussion of the fundamental principles, applications, and relative merits of Venturi tubes, flow nozzles and orifices as applied to the measurement of water, air, sewage and sludges. To the novice the treatment of the subject is all new; to the experienced it has that value of being memory refreshing and also in several particulars entirely new.

"Garbage Disposal via Sewage Treatment Works" is a subject of considerable current interest. Cecil K. Calvert, Engineer-Manager of Waste Disposal Plants at Indianapolis, Ind., will disclose the results of large scale experiments, wherein ground or shredded garbage has been put through the Indianapolis Activated Sludge plant in varying quantities. The discussion and disclosures resulting from this pioneering enterprise will prove both interesting and illuminating.

"Forgotten Meters" is the subject of an article by Earl A. Smith, a practical mechanic with a variety of experience in the field, and now Chief Meter Inspector for the Badger Meter Co. He discusses the care and maintenance of meters and gives suggestions of value in meter shop practice.

"Scale and Corrosion Control in Aqueous Systems" is to be dealt with by D. W. Haering, Chemical Engineer of Chicago, Ill. The most effective modern water corrosion control practices and the application of corrosion inhibitors will be discussed.

"Sewerage Kinks": In this issue is an article by A. M. Rawn of Los Angeles which tells of the use of rubber beachballs for cleaning sewers. In a near future issue Mr. Rawn will disclose additional "kinks" employed in operation and maintenance of the Los Angeles County Sanitation District's Sewerage system and treatment plants.

"Superintendents and Fire Departments" is the topic discussed by Sherwood Brockwell, State Fire Marshal for North Carolina. Suggestions are set forth to indicate how Water Works Superintendents can be instrumental in bringing about improved efficiencies in the functioning of Fire Departments.

"Water Supply Requirements in Brewing and Distilling": By F. J. Lammers, International Filter Co., Chicago, Ill. will tell of the water supply requirements for beer and liquor making and discuss water treatment as practiced within those industries.

Chas. C. Agar, Sr., Sanitary Engr., New York State Department of Health, will describe the use of a small portable gas engine driven centrifugal pump for pumping plant effluent for flushing, lawn sprinkling and hosing down operations at sewage treatment plants.

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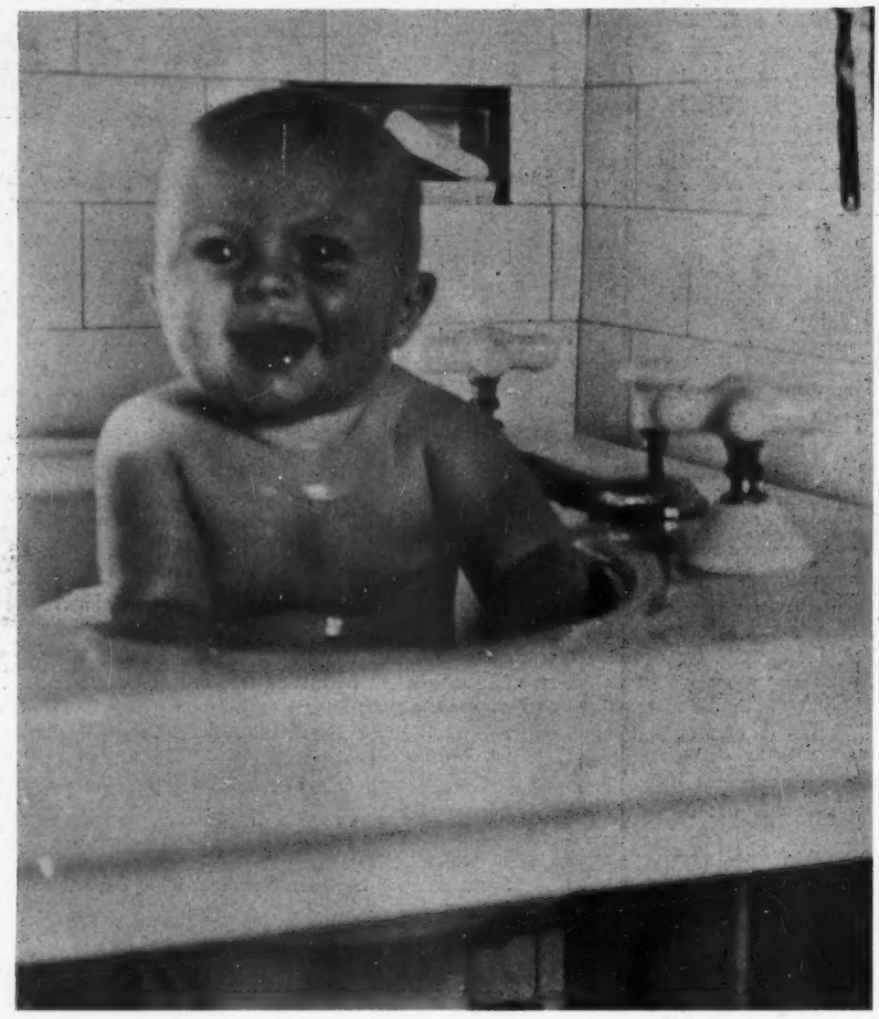
He *depends* on YOU



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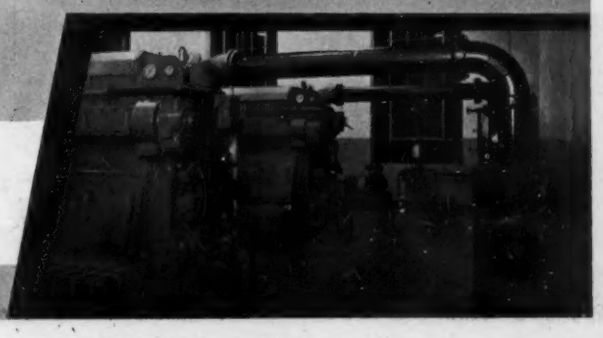
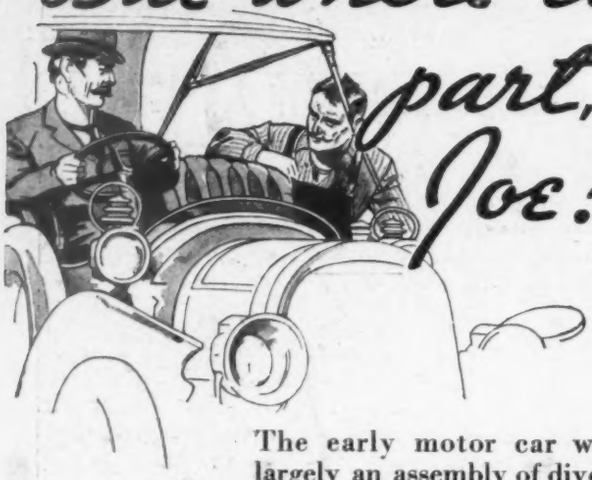


Cooper-Bessemer gas engines utilize by-product gas at the North Side Sewage Plant, Durham, N. C.—a recently completed FERA project, with William E. Piatt (E. E., M. S.) as consulting and designing engineer.

"But where can I get a new part, Joe?"



The early motor car was largely an assembly of divergent parts from many different manufacturers. Today, it is a unified mechanism, every part manufactured by or to the strict specifications of the manufacturer. There is *one* responsibility for its proper functioning, and effective standardization in replacement parts.

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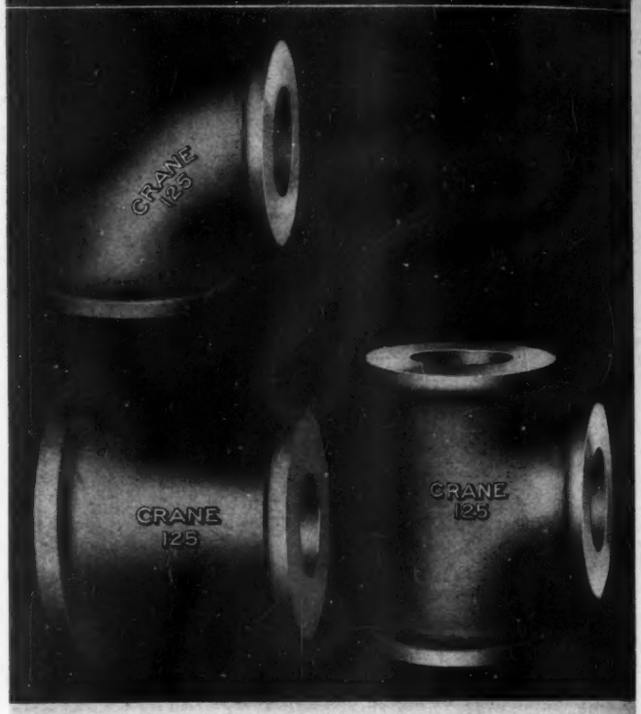

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An Interview with W. F. Luby, Engineer, Bureau of Water

W. F. Luby

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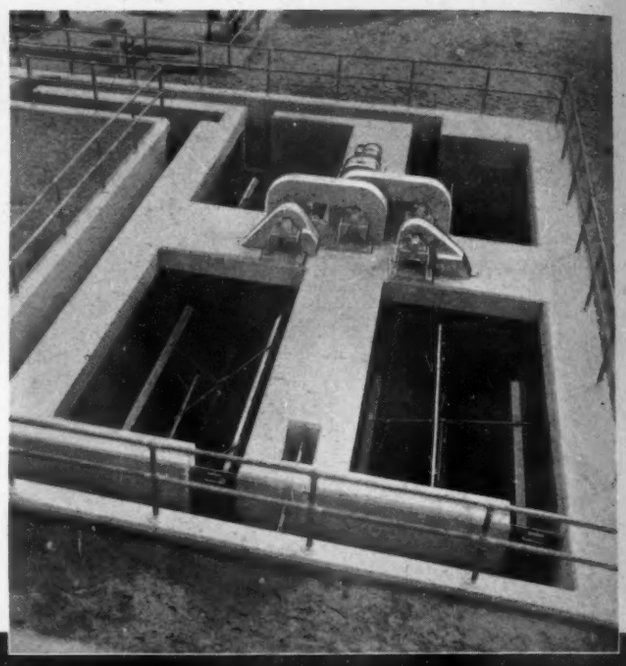
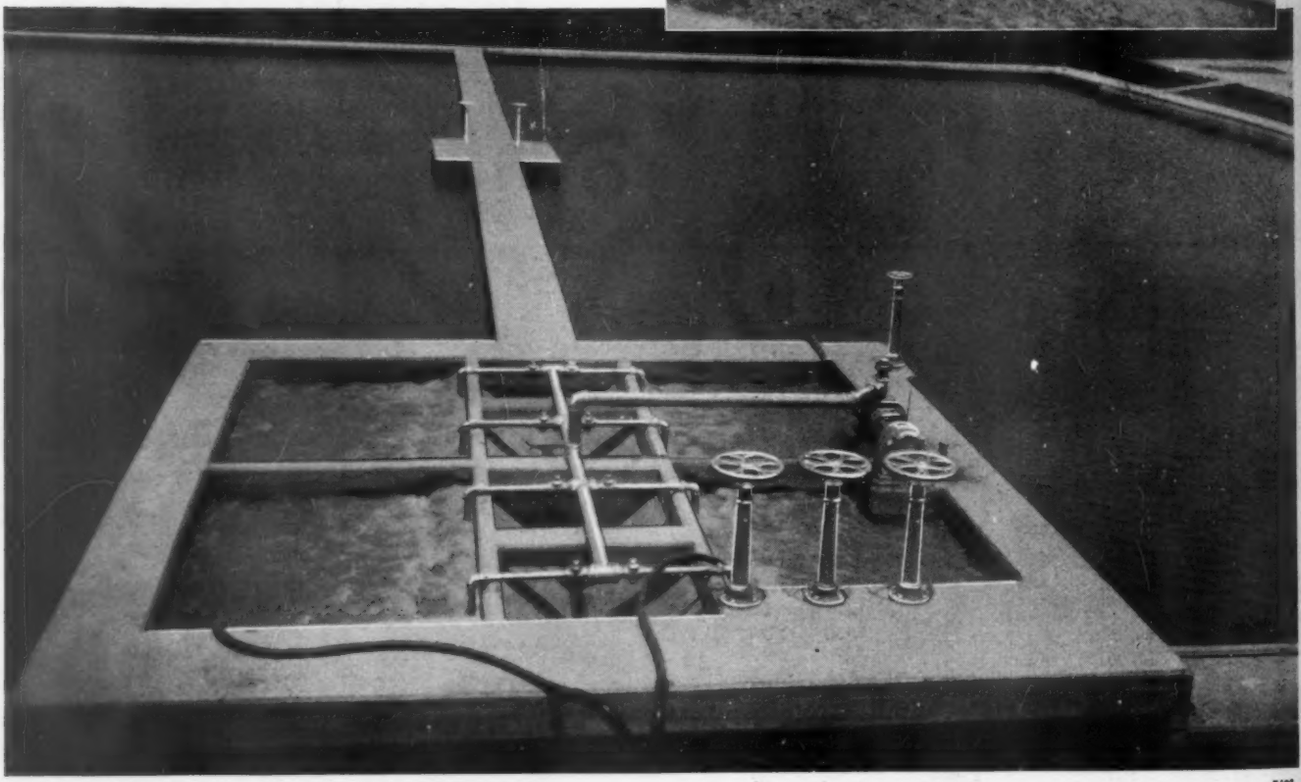
The Link-Belt mechanical flocculation units (upper illustration) possesses the same desirable features as the elevated diffuser. The speed may be varied and the degree of agitation also varied without changing the speed.





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For the four 90-ft. concrete treatment tanks of the Coney Island Sewage Treatment Works, Everdur Metal was selected for the effluent weir plates. More than 100 of these plates, 3/16″ thick, aggregating approximately 7,000 pounds, were used in this installation. Milled with 3/16″ slots, 4″ long on 3/8″ centers, relieved on the under side, these plates were anchored with 1″ x 2 1/2″ bolts of the same strong, rust proof, corrosion resisting metal—Everdur.

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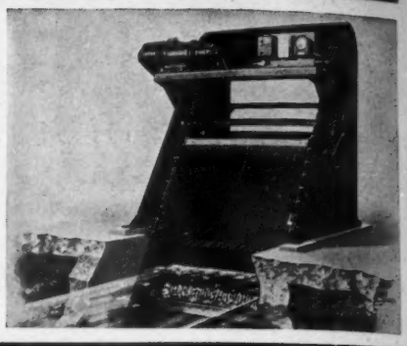

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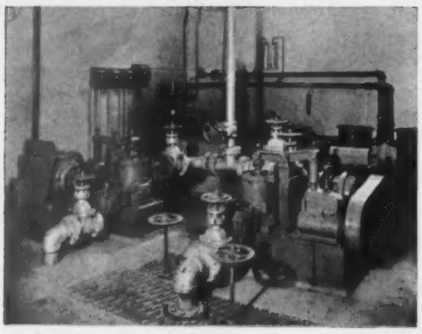
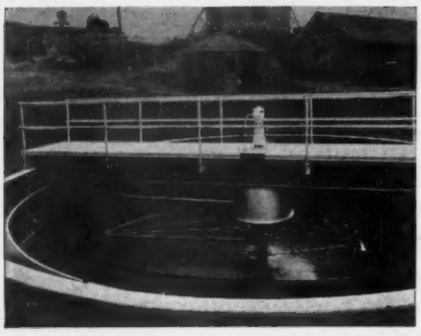
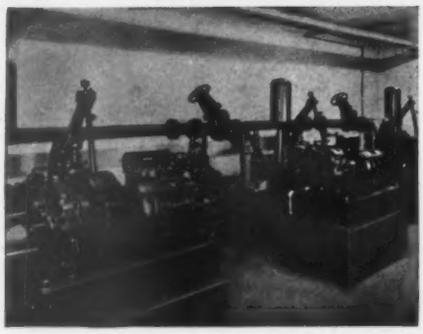
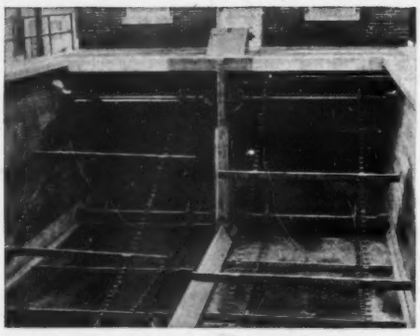
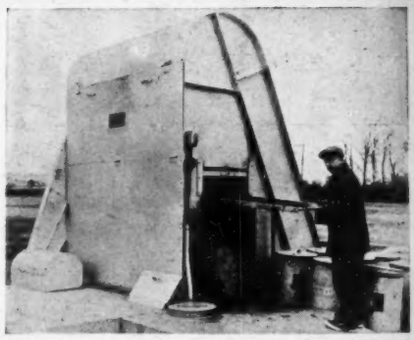




In Sewage Disposal and Water Treatment Plants







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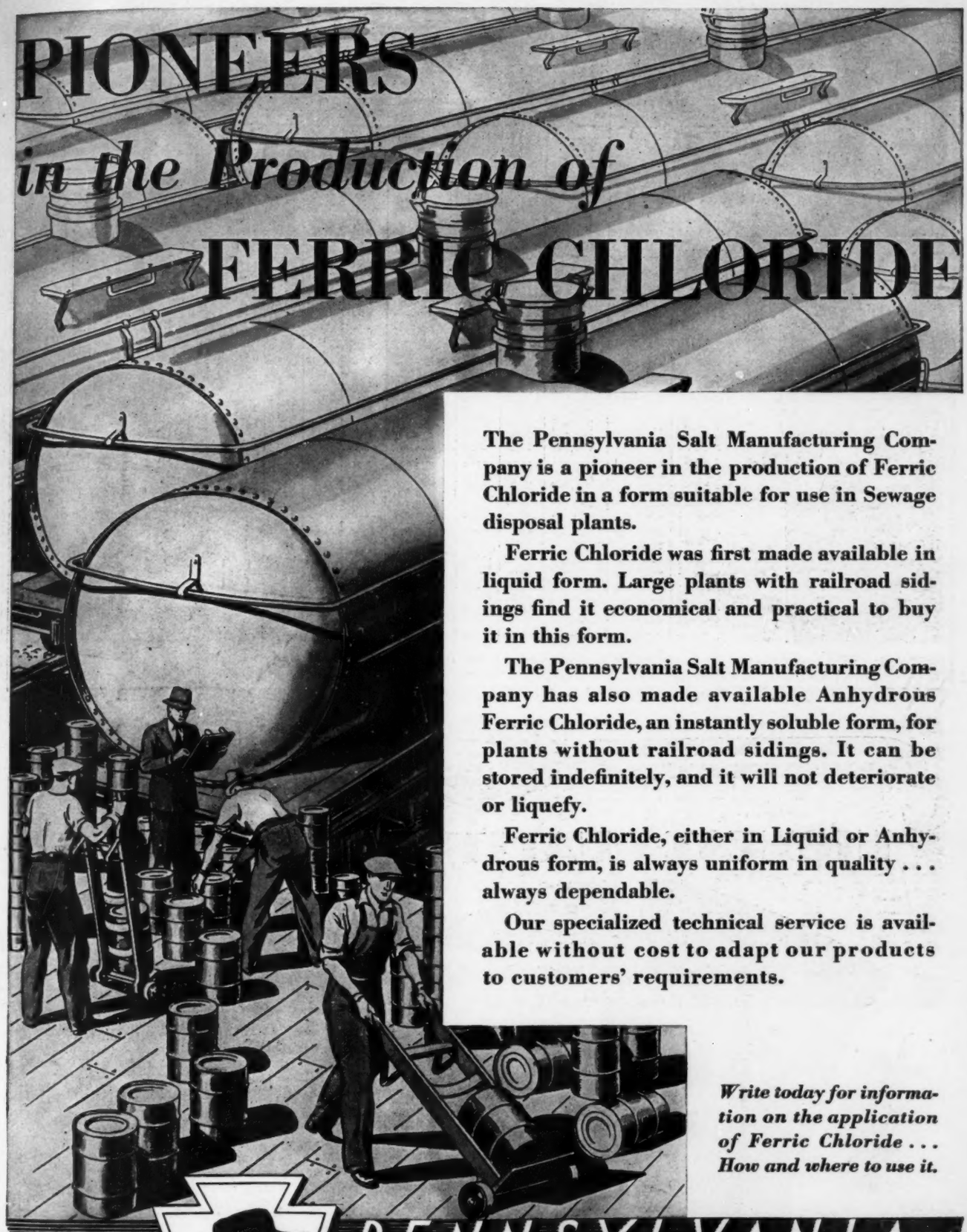

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DIVISION OF AMERICAN RADIATOR COMPANY

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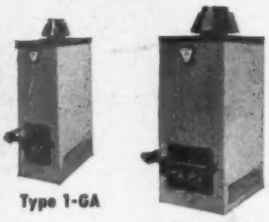
Steam	Water	B.T.U. per Hour	Sq. Ft. Steam A.G.A. Rating	Sq. Ft. Water A.G.A. Rating	B.T.U. per Hour	Cu. Ft. 700 B.T.U Sludge Gas	Over-all Hght.	Floor Space Width Front	Floor Space Depth
.....	1-GA-4	31,500	.....	210	39,350	56	36¼"	14½"	22½"
.....	1-GA-5	42,000	.....	280	52,500	75	36¼	14½	25½
.....	1-GA-6	52,500	.....	350	65,600	94	36¼	14½	28½
.....	1-GA-7	63,000	.....	420	78,750	113	38	14½	31½
.....	2-GA-4	63,000	.....	420	78,750	113	41¼	19½	22½
.....	2-GA-5	84,000	.....	560	105,000	150	41¼	19½	25½
.....	2-GA-6	105,000	.....	700	131,200	188	41¼	19½	28½
.....	2-GA-7	126,000	.....	840	157,500	225	41¼	19½	31½
.....	4-GA-9	168,000	.....	1120	210,000	300	41½	28	38
.....	4-GA-11	210,000	.....	1400	262,500	375	41½	28	44
.....	4-GA-13	252,000	.....	1680	315,000	450	41½	28	50
0-GS-4	.....	64,800	270	.....	81,200	116	52	23¼	28
0-GS-5	.....	86,400	360	.....	108,000	154	53	23½	31
0-GS-6	.....	108,000	450	.....	135,000	193	53	23½	34
0-GS-7	.....	129,600	540	.....	162,000	232	53	23½	37
1-GS-4	1-GW-4	146,000	610	980	182,500	261	50	35*	33¾
1-GS-5	1-GW-5	186,000	775	1240	232,500	332	52½	39*	33¾
1-GS-6	1-GW-6	225,000	940	1500	281,500	402	53¼	43*	33¾
1-GS-7	1-GW-7	265,000	1105	1770	331,000	473	53¾	47*	33¾
1-GS-8	1-GW-8	305,000	1270	2030	381,000	545	54¾	51*	33¾
1-GS-9	1-GW-9	345,000	1435	2300	431,000	616	57½	55*	33¾
1-GS-10	1-GW-10	384,000	1600	2560	480,000	686	58¼	59*	33¾
1-GS-11	1-GW-11	424,000	1765	2820	530,000	757	58¾	63*	33¾
4-GS-6	4-GW-6	480,000	2000	3200	600,000	857	69	53	52
4-GS-7	4-GW-7	576,000	2400	3840	722,000	1030	69¾	58	52
4-GS-8	4-GW-8	672,000	2800	4480	840,000	1200	71¾	62	52
4-GS-9	4-GW-9	768,000	3200	5120	960,000	1372	72½	66	52
4-GS-10	4-GW-10	864,000	3600	5769	1,079,000	1543	75	70	52
4-GS-11	4-GW-11	960,000	4000	6400	1,200,000	1715	75¾	74	52
4-GS-13	4-GW-13	1,152,000	4800	7680	1,440,000	2060	69¾	85	64
4-GS-15	4-GW-15	1,344,000	5600	8960	1,680,000	2400	71¾	93	64
4-GS-17	4-GW-17	1,536,000	6400	10240	1,920,000	2740	72½	103	64
4-GS-19	4-GW-19	1,728,000	7200	11520	2,162,000	3090	75	107	64
4-GS-21	4-GW-21	1,920,000	8000	12800	2,400,000	3425	75¾	110	64
4-GS-22	4-GW-22	2,016,000	8400	13440	2,520,000	3600	71¾	136	64
4-GS-25	4-GW-25	2,304,000	9600	15360	2,880,000	4120	72½	148	64
4-GS-28	4-GW-28	2,592,000	10800	17280	3,240,000	4625	75	160	64
4-GS-31	4-GW-31	2,880,000	12000	19200	3,600,000	5145	75¾	172	64
4-GS-33	4-GW-33	3,072,000	12800	20480	3,840,000	5480	72½	186	64
4-GS-37	4-GW-37	3,456,000	14400	23040	4,320,000	6165	75	202	64
4-GS-41	4-GW-41	3,840,000	16000	25600	4,800,000	6850	75¾	218	64

*1-GS shown. The 1-GW is 4" shorter.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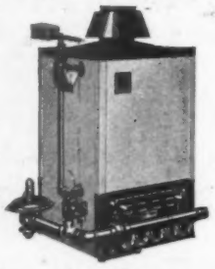
Type 2-GA

Type 4-GA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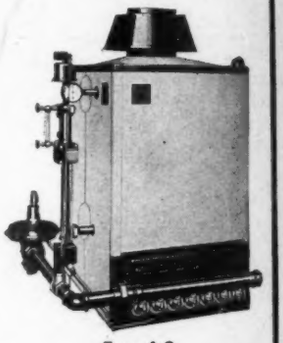
Type 0-G


Type 4-G

L.F.C.

HIGHEST QUALITY CASTINGS *PLUS*

60x42x42

QUICK DELIVERIES

—spell economy on any job!—For more than 50 years "Lynchburg" has been famed for it's high quality castings, and it's unusually quick deliveries—Many so-called "Specials" in other foundries are every day routine at "Lynchburg."—"Lynchburg Service" insures you against expensive delays.

Bell and Spigot Pipe and Fittings
From 4" to 54"
Cast Iron Flanged Pipe
From 3" to 84"
Cast Iron Flanged Fittings and Flanges from 1" to 84"
de Lavaud Centrifugal Cast-Iron Pipe

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Peoples Gas Building
Chicago, Ill.

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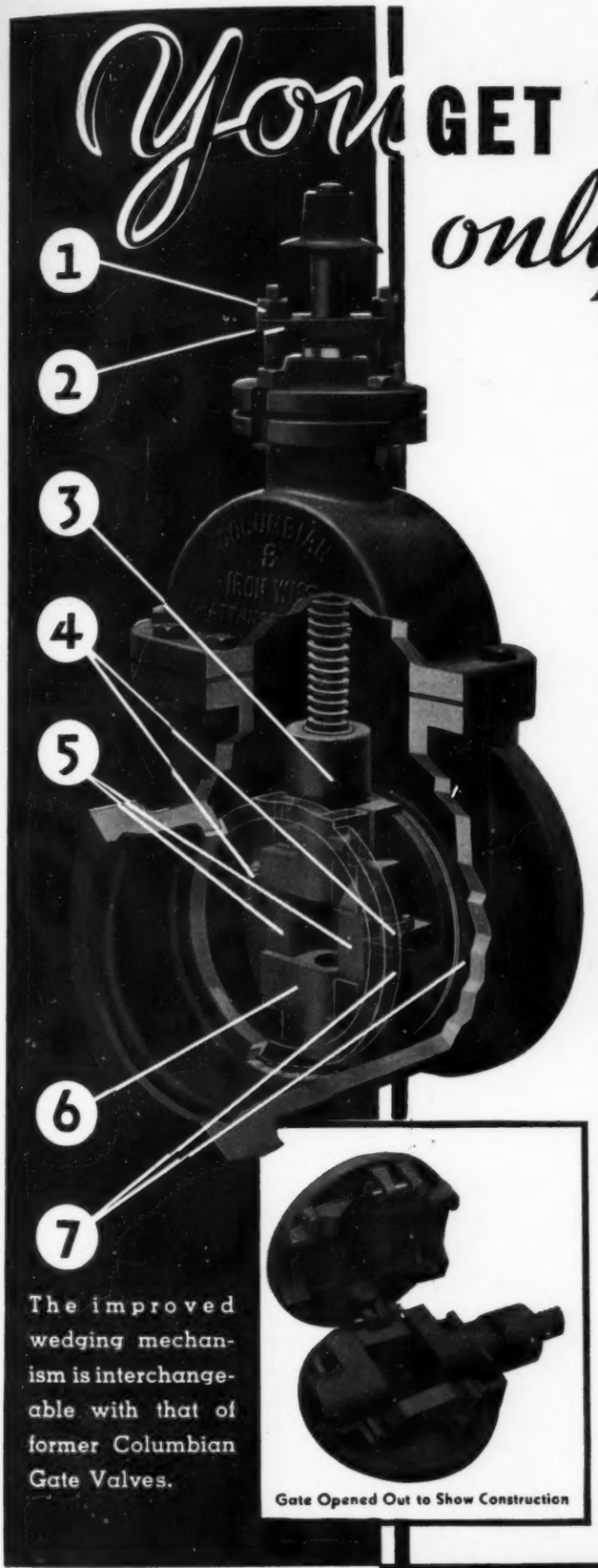

The improved wedging mechanism is interchangeable with that of former Columbian Gate Valves.

Gate Opened Out to Show Construction

You GET THESE FEATURES *only in* COLUMBIAN

JUST give the Columbian Gate Valve one careful inspection and then tell us if we are over-stating when we say it is the one gate valve that "has everything."

Here is a valve in which the stem never binds. The ball joint (2) between the bronze gland and follower prevents angular strains even when the packing nuts are tightened unequally. The non-rusting, cadmium plated packing bolts with bronze nuts (1) make re-packing easy in either open or closed positions.

The illustrations show the construction of the wedging mechanism which accomplishes an evenly distributed "4-point contact" pressure practically at the outer edges of each disc. It consists of a top wedge (3) and bottom wedge (6) with two side spreaders (5) which equalize the pressure on the discs (7). When the discs reach the bottom of their travel, causing the top and bottom wedge nuts to converge, the inclined planes of the wedges force the discs against the seating surfaces with an absolutely evenly distributed pressure.

As a result of this construction there is no scraping of discs across seats because they are automatically contracted by a reversal of the spreading action before rising. Since the wedging pressure is applied at the outer edge of the discs, there is no possibility of sprung discs. The mechanism keeps all wedging action in a straight line so there is no side strain on the stem under any conditions.

Columbian Gate Valves do not leak because seat rings are machine finished and ground with faces absolutely parallel. The small, precise clearances between the discs effectively shear off all incrustations. Ask for description of this advanced gate valve that provides for every conceivable service condition.

COLUMBIAN IRON WORKS
Chattanooga, Tennessee
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Your FUTURE fire hydrant—

Ask for facts about the fire hydrant with self-oiling top, safety flange and coupling and many other features that are combined in no other hydrant.

COLUMBIAN

FIRE HYDRANTS and GATE VALVES

In service since 1847 *under historic Boston Common*

Water Works Improvements Are Sound Relief Projects

1. Water supply improvements constructed with cast iron pipe pay for themselves.

2. Approximately 75% of the cost of manufacturing, distributing and installing cast iron pipe, including raw materials, goes directly to workmen.

3. Manufacturing and installing one mile of 6-inch cast iron pipe gives approximately 1000 man days of employment.

4. For every 100 tons of cast iron pipe manufactured, the railroads handle approximately 1000 tons of material.

John Quincy Adams dug the first spadeful of earth for the excavation when this cast iron pipe line was laid 88 years ago.

THERE was a holiday celebration on Boston Common when the water was turned on in Boston's first cast iron water line and children sang an ode written for the occasion by James Russell Lowell. A section of this cast iron line which is still in service was recently uncovered and found in perfect condition.

The long life of cast iron pipe is evidenced by mains still in use in America and Europe after from one to nearly three centuries of service. It is the recognized standard material for water and gas mains. Engineers rate its useful life, in evaluating bids, at 100 years, far beyond that of other materials used for underground mains.

Cast iron pipe *costs less per service year* and *least to maintain* because it effectively resists rust. It is the one ferrous metal pipe for water and gas mains, and for sewer construction, that will not disintegrate from rust.

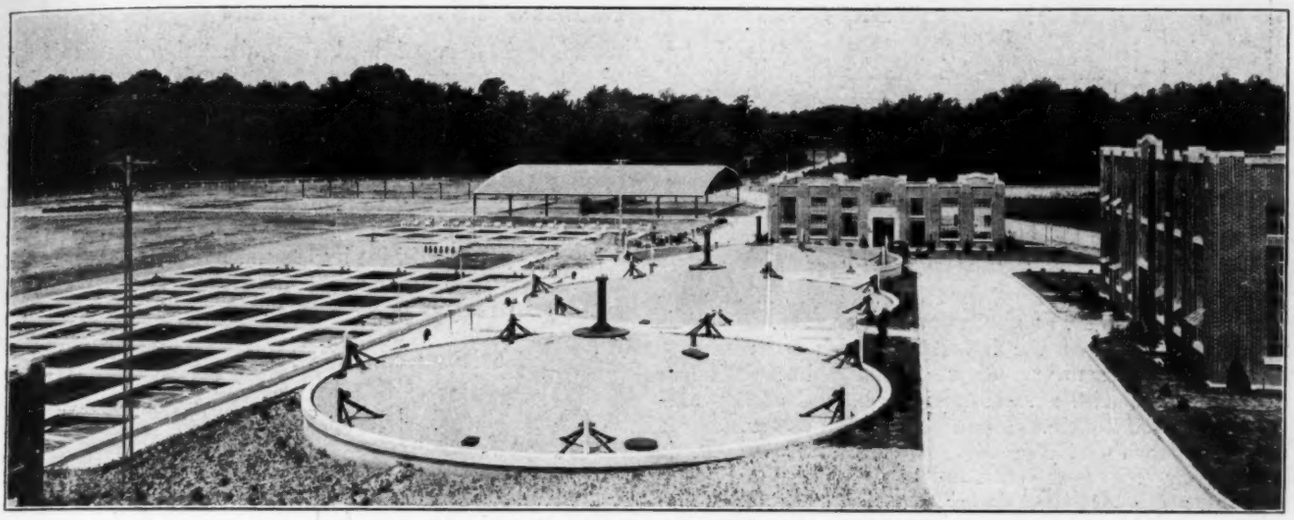
Communities should take advantage of the present favorable municipal bond market and Government grants to modernize, enlarge or extend water distribution systems, or to build new supply lines. With Federal aid, pipe line improvements can be secured for a fraction of their usual cost. Further information may be obtained through The Cast Iron Pipe Research Association, Thomas F. Wolfe, Research Engineer, 1015 Peoples Gas Bldg., Chicago, Illinois.

CAST IRON PIPE

METHODS OF EVALUATING BIDS NOW IN USE BY ENGINEERS RATE THE USEFUL LIFE OF CAST IRON PIPE AT 100 YEARS

TRADEMARK REG.

WATER WORKS AND SEWERAGE
A GILLETTE PUBLICATION
VOL. LXXXII OCTOBER, 1935 NO. 10



A General View of Durham's Treatment Works. The Picture Was Taken from the Gas-Holder and Looks Toward the Inlet End of the Plant. (Rear and Left): Sludge Beds, Primary Tanks, Returned Sludge "Allocator," Central Diffuser Aeration Units, Activated Sludge and Effluent Water Pump House. (Rear and Center): Sludge Pump and Conditioning House and Laboratory, 3 Floating Cover Digesters. (Right): Power and Blower House. Screen House and Final Tanks (Left) Not Visible

FEATURES OF THE NEW NORTHSIDE SEWAGE TREATMENT WORKS OF DURHAM, N. C.

By WILLIAM M. PIATT, C. E.
Durham, N. C.

The Author

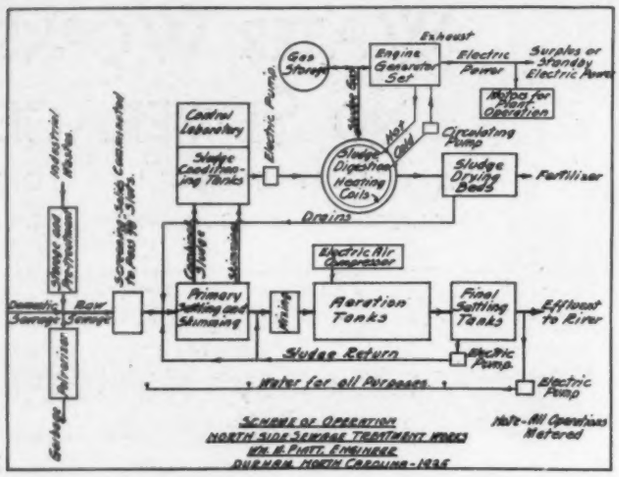
THE story of sewage treatment in the city of Durham, N. C., has been, in a large measure, one of coordinating three public utilities as well as that of gaining industrial cooperation.

Not only is Durham the birthplace and home of the great tobacco industry where Lucky Strikes and Chesterfields as well as many other famous brands of cigarettes are produced daily by the millions, but it is also a substantial textile and hosiery center. The wastes from these industries have entered the city's sewers for many years and the combined wastes discharged untreated through an outfall some ten miles in length into the Neuse River. The character of the textile mill wastes presented a problem difficult to solve satisfactorily. Some are highly caustic, with oxygen demands ranging up to more than 6,000.* Many of them are highly colored and their intermittent discharges at high rates intensified the problem.

*See Journal of N. C. Section of A. W. W. A. for 1928.

Due to early contracts, under which the outfalls were financed by the industries, the city was faced with the necessity for making substantial refunds in the event that the industries were excluded from the sanitary sewers. Furthermore, the industries were faced with very serious problems if compelled to treat their wastes independently, due to the fact that over the years of inattention a large city had grown up around these industries closely hemming them in. It therefore seemed desirable to consider the industrial waste problem and the municipal sewage problem in a program of coordination.

The city of Durham is located on a long ridge, intersected by many ravines, running in an easterly direction, which divides the drainage of the city very definitely. The south side of the city is almost wholly residential and is tributary to the Cape Fear River Drainage Basin. This section of the city has been served for years by the Third Fork Sewage Disposal Plant with Sprinkling Filters of the conventional type having a capacity of 2,000,000 gallons per day. A second Sprinkling Filter plant known as the New Hope Creek Sewage Disposal plant with a capacity of 750,000 gallons per day was completed and placed in operation during the past two years and serves a small residential area and the new Duke University, located in a reserve



Flow Sheet, Showing Units and Scheme of Operation of Durham's New Treatment Works

of some 6,000 acres southwest of the city. A description of this plant will appear at a later date.

Practically all of the industries which contribute to the flow in the sanitary sewers are located on the north side, together with a residential population of approximately 30,000 people. The drainage of this territory is tributary to the Neuse River drainage basin and is served by the new North Side Sewage Treatment Works, a more detailed description of which is the main theme of this article.

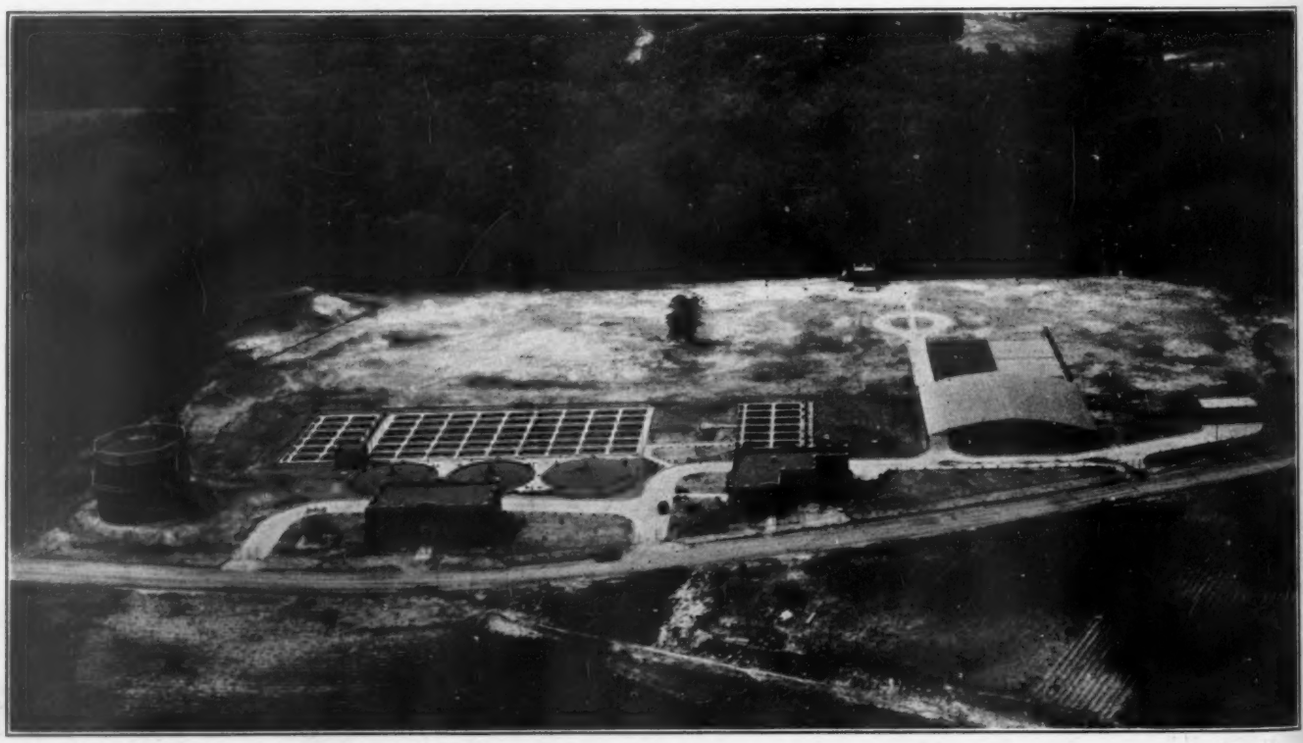
In common with many cities in the United States the sanitary sewers of the city of Durham were originally built and operated as a governmental function and paid for by ad valorem taxation. The water supply of the city was originally furnished by the Durham Water Company, a private corporation deriving its supply from Eno River, some eight or ten miles northeast of the city. In 1916 a Municipal Water Works was constructed deriving its supply from Flat River, the most remote of the three rivers, and the distribution system and high level reservoir of the Durham Water Company were absorbed by purchase. The new plant consisted of a steam driven raw water pumping station at the source with a filtration plant and high lift pumping station adjacent to the city. In the absence of remedial legislation, in spite of common ownership, the city operated the water works and sanitary sewers as independent departments.

Consolidation of Profitable Water, Electric and Sewer Departments

The legislature of 1931 recognized the inseparability of water supply and disposal and made it possible for cities in North Carolina to operate consolidated water and sewer departments and authorized the incorporation in the water rate of an amount sufficient to completely finance the consolidated utility. To cover service to properties not utilizing the public water supply, sewer rental was legalized. Durham is accomplishing this consolidation of utilities by easy stages which will probably be fully consummated when the revenues at present rates are sufficient, without change, to completely finance the consolidation.

The Flat River supply without impounding proved to be inadequate and after several seasons of water shortage the city in 1925 commenced the construction of the Lake Michie Dam on Flat River together with a Hydro Electric Power plant of 1,500 kilowatt capacity and water wheel driven raw water pumps.** Recognition of the fact that in some years the city would be compelled during seasons of extreme drought to fall back upon its steam plants, which were rapidly becoming inadequate, an interchange of power agreement was entered into with the Durham Public Service Company. During the wet months the city sells to the company its surplus power and in turn buys back some of this power during the dry season. This arrangement has proven highly profitable to the city. During the past fiscal year,

**Note:—On the water-supply and power development projects the author of this article also served as consultant and designing engineer.—Editor.



The New Northside Plant of the Durham, N. C., Sewerage System

in addition to producing its own power requirements at a fuel saving estimated at $40,000, Durham has sold surplus power amounting to approximately $35,000.

The daily water consumption of the entire city averages approximately 5,000,000 gallons with a maximum of 6,300,000 per day, of which amount 40 per cent reaches the sewers on the south side of the city, the remainder being used by the industries and homes on the north side of the city.

Development of North Side Sewage Treatment Project

The design for the North Side Sewage Treatment Works and method of treatment was largely influenced by the existence of the Lake Michie Hydro Electric Plant, both because it would be possible to coordinate developed power with treatment plant requirements and also to meet requirements during low flows in Neuse River throughout periods when water was being stored behind the dam.

As previously stated, sewage originating on the north side has for many years been dumped untreated into the Neuse River. However, Durham was really a pioneer in the matter of sewage treatment and in 1902 near the site of the present North Side Plant constructed what was known as the Ellerbe Creek Plant, consisting of Cameron Type Septic tanks followed by two sets of primary and secondary contact filters. The plant was highly efficient but was soon outgrown due to the extremely rapid development of the industries. The plant was abandoned in 1916. The long series of dry years commencing with 1925 converted the upper reaches of Neuse River into essentially an open sewer, with consequent destruction of fish life and nuisance due to obnoxious odors. Much litigation resulted and the city was again forced to consider the construction of a new sewage disposal plant which, but for the depression, would have been constructed in 1930.

P.W.A. Assistance Procured

During the ensuing years, however, plans were developed and when the Federal Public Works Administration opened its office the application of the city of Durham was the very first one to be filed. An allocation of $760,000 was made in the early part of December 1933 to cover the re-construction of several miles of tributary outfalls as well as the construction of the new disposal plant. The re-construction of these outfalls, made necessary by inadequacy, made it possible to locate them

Screen House—Showing Twin Chicago Communitor Type Screens and Emergency Bar Screen By-Pass

The "Allocator" Chamber Distributes Returned Sludge Equitably to Aeration Tanks Through Adjustable Weirs

at a higher elevation than the old outfalls, removing the necessity for a lift station at the plant, leaving nothing but sludge to be pumped at the new plant. The new works were started in January 1934 and final settlement was made with the various contractors in April of the present year. The program of putting the plant into operation was started in October 1934, however, and brought up to full operation as the work was completed.

Industrial Cooperation

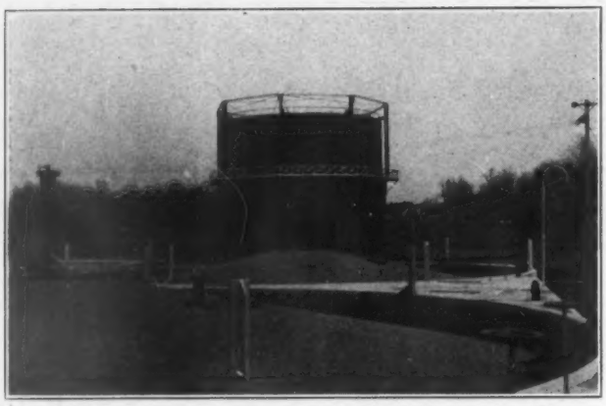
In order to insure satisfactory operation of whatever type of sewage disposal plant was to be built an early understanding was reached between the city and the industries under which the latter agreed to construct such pre-treatment works as found requisite to insure a uniform quality of waste discharge, properly distributed throughout the day, and with such chemical treatment as might be necessary to reduce loadings on the municipal system to meet standards to be determined by the city.

This program on the part of the industries has suffered many delays, but is going forward slowly and surely and it is expected that by the first of the coming year that all of these pre-treatment plants will be in full operation. Several of these plants, including two which employ the highly troublesome sulphur dyes, are now in satisfactory operation.

In addition to the above, on an experimental basis, the city is satisfactorily pulverizing a small amount of wet garbage from one of the city's incinerators and dumping it into the sanitary sewer. This has been particularly helpful to the city during the watermelon and cantaloupe season because these highly watery materials are particularly difficult and costly to incinerate. The city will extend this garbage treatment program during the coming season and, so far, the results seem to bear out the conclusions reached by Cohn in his pioneer work at Schenectady.

The North Side Sewage Treatment Plant

The North Side Sewage Treatment Plant is essentially of the Activated Sludge type with primary sedimentation and skimming, alkaline digestion of combined sludges and skimmings, with resultant gases being used for the production *of all of the power needed for the plant operation.* Uniform elevated temperature in sludge digestion is maintained by the recovery of heat as the by-product from the gas engines used to generate electric power. Digested sludge is dried on both open and covered sand beds, the dry sludge being pul-



The 50,000 Cu. Ft. Chicago Gas Holder—Serves the Essential Role of Storage Reservoir in Power Production. The Gas Domes (Riser Pipes) Are Seen at the Center of the Downes Floating-Covers on the Digesters in Foreground

verized and used for fertilizer. The accompanying schematic flow sketch, showing the method of operation will be helpful to the reader in understanding the description which follows.

The plant is located at the confluence of two main 30 in. outfalls of C.I. pipe on concrete piers which are brought into the screen house across the surrounding swamp.

Screens and Comminutors

This screen house contains two 25 in. Chicago Revolving Comminutor Screens with ⅜ in. slots and equipped with comminutor teeth for cutting up coarse screenings into pieces fine enough to pass through the slots. Installed between the comminutors is a hand cleaned plain bar screen to be used in emergencies. It has, however, been unnecessary to use this screen since the Chicago comminutors were put in operation in October 1934. The comminutors discharge downward into an open chamber which contains one set of Aloxite diffuser plates for the admission of air. This open chamber contains two submerged outlets, one of which is blanked for use when the plant is extended, the second leads to the primary settling tanks. The submerged outlets insure the continuous passage of sand into the primary settling tanks and the use of air not alone helps to dissipate initial odors but also insures that floating materials will not lodge in the chamber but will pass on out with the sewage. It has not been at any time necessary to remove any floating materials from this chamber and the arrangements eliminates the necessity for removing sand as a separate operation.

Primary Settling Tanks

The primary settling tanks, six in number, are each approximately 50 ft. long by 15 ft. wide with a liquid depth varying from 11 ft. 3 in. at the outlet end to 12 ft. 3 in. at the inlet end. A skimming trough at the outlet end of the tanks serves as a baffle to hold floating matters in the tanks.

Two conical hoppers at the inlet end, with an eduction pipe in the center of each, serve as concentration sumps, the upper end of the eduction pipes being provided with adjustable overflows for sludge withdrawal. The main tanks are equipped with Chain Belt Co.'s longitudinal conveyor type sludge removers, which scrape the sludge into the conical hoppers and on return across the surface serve to concentrate the skimmings at the outlet end where they are discharged into the skimming trough. Each of the conical hoppers is also equipped with a rotating thickening scraper. The operating mechanism for each of the primary settling tanks comprises one unit with its separate single motor drive. This particular feature has proven very satisfactory in comparison with the more common method of using a counter shaft to drive all of the units with a single motor.

Careful measurements have determined that, under almost any condition, even when operating dry, the power requirements of these units to be less than one-third of a horsepower, largely due to the slow belt speed of one foot per minute.

Almost any degree of concentration is automatically obtained by the method of sludge withdrawal adopted and no further concentration was apparent when the sludge was held for attempted further concentration after withdrawal from these tanks. Since excess sludge from the Activated Sludge process is discharged into the raw sewage all of the sludge from the entire plant is concentrated in these primary settling tanks and upon withdrawal may be immediately and continuously discharged to the digesters by means of a Nash Ejector in the sludge control house, or held for conditioning with lime and then pumped.

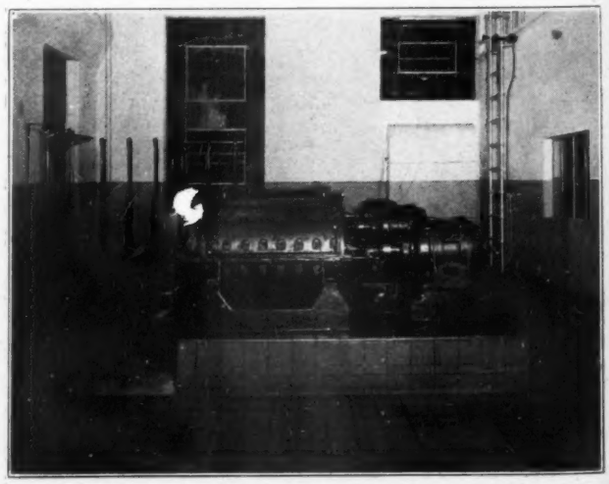
Sludge Control House

The sludge control house contains three inclined bottom tanks of approximately 15,000 gallons capacity each, to which sludge or drainage from any part of the entire plant can be drawn for conditioning or removal to other points by means of two Chicago Vertical pumps in the basement, with motors on the main operating floor. Each of these tanks is equipped with aerators for mechanical mixing in the event that it is desirable to add any chemicals or if it is desired to aerate any of the wastes. A later reference will be made to this feature. Normally sludge is withdrawn from the primary settling tanks into one of the above mentioned tanks serving as a collecting or equalizing tank, and is intermittently pumped direct to the digesters.

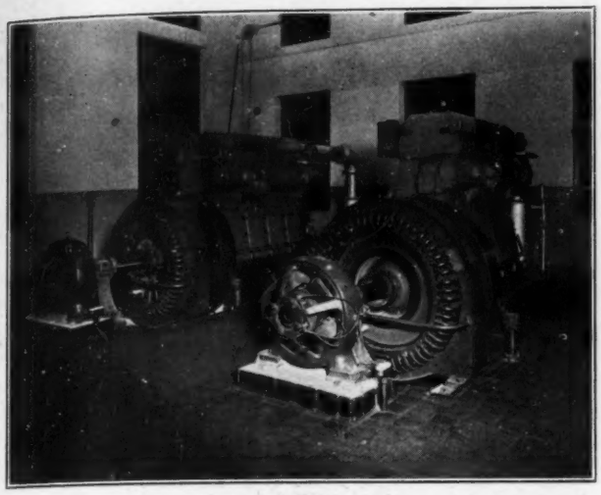
Two small tanks in the same house receive the skimmings from the primary settling tanks wherein they are further concentrated, the clear liquid underneath being pumped back into the raw sewage and the skimmings pumped direct to the digesters.

Sludge Digesters

The digesters, three in number, are 60 ft. in diameter and have a capacity of approximately 450,000 gallons each. They are equipped with Downes Floating Covers, each having 3 in. reinforced concrete roof further in-



Power Station and Blower House—Showing Rate of Flow Monometers (Left and Rear) on Lines to Aeration Units and Three G. E.-Ingersoll Rand Blowers



Interior of Power House—Showing Twin. Cooper-Bessemer Gas Engines and G. E. Generators Which Operate Continuously to Produce More Power Than Is Required by the Plant

sulated with a 1 in. layer of cork and 5 ply Barrett tar and grovel roofing. The walls of the tanks are largely below the ground level and embankments on the lower side serve to complete their insulation. Each of the tanks is equipped with heating coils of 2 in. wrought-iron pipe for the circulation of hot water for maintaining uniform digestion temperature. Ordinarily the tanks are operated at 82 degrees F.

Gas from the digesters is withdrawn from the top of a riser pipe (gas dome) at the center of the covers through a telescope vertical gas take-off pipe on the inside center of the dome. It is carried out below the floating cover into the main gas header which supplies the plant. Control rooms between the digesters contain the necessary valves and piping for controlling the withdral of sludge and supernatant liquor and also the inlet of raw solids.

In one of the control rooms are also two Morris centrifugal pumps (75 g.p.m. capacity each) for circulating hot water through all of the digesters, either pump being sufficient to perform the service. Each digester is equipped with a Bristol Recording Thermometer, with a weekly chart, for recording tank temperatures. A double pen recording thermometer records the temperature of the circulating water at inlet and outlet of the heating coils. Each digester is equipped with a 2 in. Keystone water meter for measuring the quantity of water circulated and a 2½ in. Pittsburgh gas meter measures the gas. On account of the large volume of sludge in these digesters, in comparison with the quantity of fresh solids added each day, temperature changes are very low and manual control of the equipment has been very satisfactory.

Gas Holder and Gas Engines

Gas storage is taken care of with a single life gasholder of all welded steel construction, having a capacity of 50,000 cubic feet with a working pressure of 6 in. of water. This gas holder was constructed by the Chicago Bridge and Iron Works. All of the gas produced is used for the production of electric power.

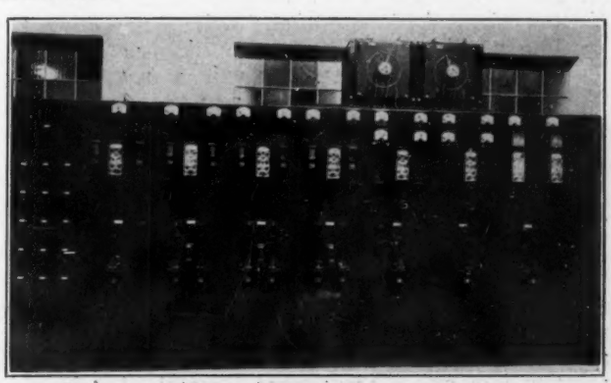
The power equipment consists of two four cylinder, four cycle Cooper-Bessemer Vertical Gas Engines, designed to operate on natural gas and produce 150 brake horsepower. Each is direct connected to a 100 kilowatt, 2,300 volt, General Electric Generator with direct connected exciters.

A nine panel General Electric Switchboard, of all steel construction, controls all of the plant operations. An outdoor substation, equipped with three 75 kilowatt 2,300 to 23,000 volt oil cooled transformers, is connected through a four mile tranmission line to the transmission line between Durham's Flat River Hydro Electric Plant and the substation of the Durham Public Service Company, which is in turn served by the lines of the Duke Power Company. This connection serves not only as a stand-by connection for the sewage plant for obtaining power either from the city's hydro electric plant or from the Duke Power Co., but also permits the interchange of power between the sewage plant and the city's hydro electric plant at any hour of the day or night. During certain seasons of the year the hydro-electric plant is only operated the minimum number of hours each day as is necessary to fill all of the service reservoirs. During the shutdown period current for lighting the homes of the operatives and for minor plant operations is supplied by current from the sewage disposal plant during which period water is stored in the lake. Whenever necessary the gas storage at the sewage plant is drawn upon to boost the current output. This power, if needed, can be returned to the sewage plant during the hours of operation of the hydro electric plant and thus more gas goes back into reserve in the gas holder at the sewage plant, which was built large for this particular service.

During the period when the sewage plant is furnishing light to the hydro electric plant the main substation at the hydro plant is disconnected and a smaller power transformer is used to avoid the heavy losses of the larger bank which amount to approximately 40 kilowatts. Later it is planned to perform a similar service at night for Durham's filtration plant—i.e., as soon as a small transformer can be added which will enable the larger substation at the filter plant to be disconnected. At the present time sufficient gas is being produced at the sewage plant to perform all of the plant operations and furnish lighting service to the hydro electric plant without calling for any return of power.

Recording Gas Calorimeter

The quality of the gas being produced by the digesters can be closely watched by means of a Precision Recording Calorimeter installed in the laboratory. It has been found that unfavorable conditions developing in the digestion tanks can be detected on the calorimeter records long before they are evidenced by conventional pH determinations, which at best probably only give a clue to the condition existing at the point where the sample is taken. The Precision Calorimeter record is a direct indication of the relative amounts of methane and CO_2 being produced. Lime correction, when needed, can be made before any trouble gets headway in the digesters. A separate gas header which may be connected to any one of the digesters supplies gas to the calorimeter.



Main 9-Panel G. D. Switchboard in Power House

Heat Recovery

Edge-Moor Thimble Type Water Heaters are inserted in each of the engine exhaust pipes and this hot water is combined with that from the engine jackets to furnish hot water for heating the digestion tanks. The water connections are so arranged that the amount of water passing through the jackets can be regulated for proper operating engine temperature, the amount of water through the heater for maximum heat recovery and a by-pass connection enables the operator to control the temperature of the water circulating in the coils to the digesters. Ordinarily water circulating in the digester coils is limited to a maximum of 115 degrees F. inlet temperature with an outlet temperature of approximately 84 degrees. During the summer months when no heat is needed in the digesters the plant effluent is used for cooling the engine and preventing damage to the heater, the hot water being returned to the sewer. At other seasons by proper adjustment any part of the heat can be so wasted.

The power plant has been in continuous operation since November 1934 and has been entirely satisfactory. The Cooper-Bessemer engines have recently been torn down for inspection and found to be in perfect condition.

New Principle in Air Diffusion

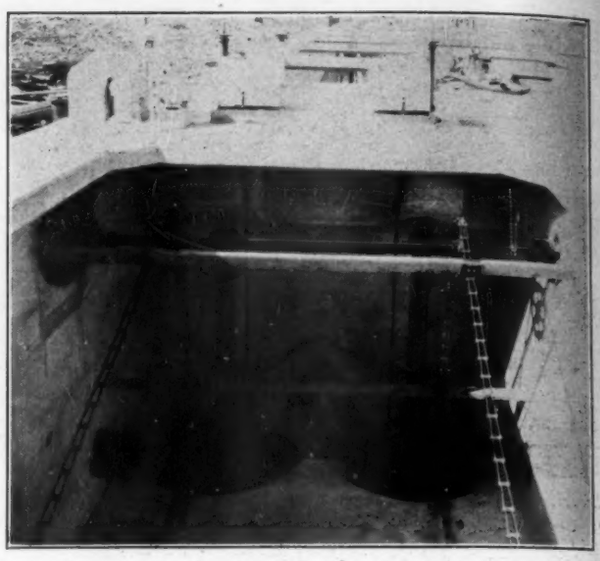
The effluent from the primary settling tanks is gathered together in the final channel leading to a distribution chamber which also serves as a mixing chamber for the seeding sludge returned from the final settling tanks. Separate outlets equipped with adjustable orifices serve to control the quantity of sewage passing to each of the six aeration tanks. Each of these aeration tanks has a normal capacity of 1,000,000 gallons per day when operated with a retention period of approximately five hours.

The tanks are equipped with aerators of a new type consisting of unit aerators placed lengthwise of the center of the tank at the bottom. Each aerator unit of galvanized cast iron contains eight Carborundum-Aloxite Diffuser Plates, four on each side (in a vertical position) with a ½ in. air space between the plates fed from an air chamber below the plates which is an integral part of the unit. Each of the units is provided with 4 in. flanged inlet and outlet which, when the units are bolted together, form a continuous air header below the plates. From this header all water or moisture is automatically trapped at each end of it.

As originally installed this header at the bottom of the tank was fed at two points from an 8 in. main header for each of the separate tanks. One inlet has proven entirely sufficient and it is probable that the extra piping will eventually be removed from the units. The vertical position of the aeration plates serves as an automatic regulator with a uniform distribution of the air throughout the length of the tank. In addition, they are in a position to be easily cleaned as nothing is deposited on them except such growths as naturally form. No provision has been made for removing the plates for cleaning and it has been found that if the plates are washed promptly as soon as the tanks are emptied that the simple washing with a fire hose suffices to clean them. This is not true, however, if the plates are allowed to dry out before cleaning.

Blowers

A Venturi Meter is installed in the pipe supplying air to each of the separate aeration tanks. Indicating manometers are installed in the power plant. Air for aeration is supplied from three General Electric-Ingersoll Rand low pressure blowers, installed in the power plant each having a capacity of 1,500 cubic feet per minute at 6 lb. gage. Each blower is direct connected to a 60 horsepower G. E. motor, the units operating at 3,600 r.p.m. These motors are controlled from the main switchboard. Air supplied to the blowers is drawn from a central concrete duct under the floor of the power house through American Oil Type Air Filters and provision is made for the installation of additional blowers to be connected to the same duct.



Chain-Belt Settling Tank Mechanism and Twin Concentration Cone-Hoppers, Equipped With Thickener Blades

Final Settling Tanks

Although the final settling tanks (six in number) are constructed in line with the aeration tanks as an integral part of the structure, each aeration tank is equipped with a straight weir discharging into a cross trough. The latter may be sectionalized through the manipulation of slide-gates between each unit, and thus any number of aeration tanks may be used in combination with any number of final settling tanks. The slide-gates referred to (likewise all similar gates throughout the plant) consist of galvanized iron frames anchored in the concrete and the gate leaves are made from aluminum alloy plate. These are light, easy to handle, and have proven very satisfactory in every way.

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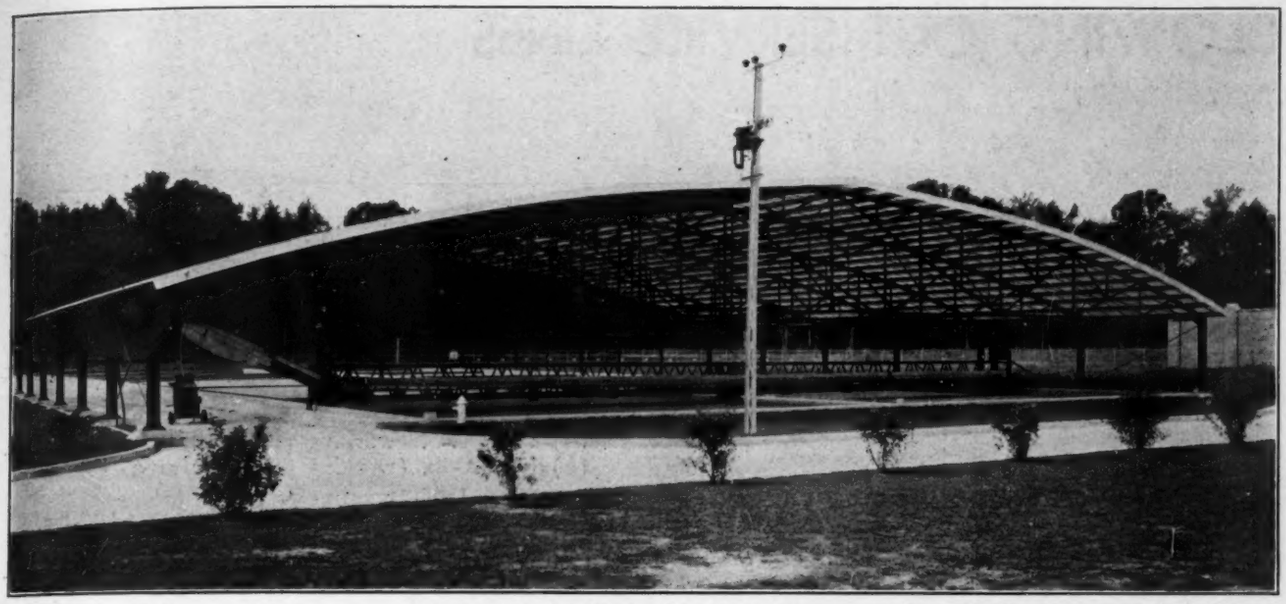
Sludge and Effluent Pumping

A small sludge pump-house adjacent to the final settling tanks contains two Chicago Vertical Centrifugal pumps installed in the basement with motors on the operating floor. These pumps serve to handle all of the sludge derived from the final settling tanks which is returned to be mixed with the effluent from the primary



Sludge Beds 40 Per Cent Under Corrugated Glass-Roofed Shed. Link-Belt Conveyor Delivers Sludge Cake to Royer Disintegrator (Left) Which Shreds It and Fills Trucks at One Operation. These Units Serve Open Beds Also, One of Which Is Devoted to Filtering Digester Supernatant

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A small sub-basement under the sludge pump house contains one Chicago Vertical Centrifugal pump which is connected to a header passing under all of the hoppers in the final settling tanks and which may be used to empty any or all of the units.

This sludge pump house also contains two Worthington Automatic Priming Motor Driven Centrifugal pumps (100 g.p.m. capacity) for furnishing effluent to the pipe distribution system throughout the works. This pump house also houses a Simplex Register Recorder for the Simplex Venturi Tube which measures the effluent from the plant.

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Digested sludge is discharged by gravity from the digesters for drying upon sand beds of conventional type with terra cotta underdrains. The beds, ten in number and in pairs, are each 50 ft. by 50 ft. with provision for drawing 12 in. of sludge upon them. An innovation is a corrugated glass roof supported by bow string trusses over four of the beds. The structure has no side walls to obstruct ventilation. Provision was made for covering all of the beds when needed. A Link Belt Conveyor, of new design, traverses all of the beds. This conveyor is loaded by hand and delivers to trucks in the driveway along one side of the beds.

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The plant has been so recently put into operation, and a full technician has been in charge of the laboratory for such a short time, that operating results must necessarily await a longer period of operation if they are not to be misleading.

The net cost of the plant to the city exclusive of outfalls, but including all other costs, is approximately $370,000.

The operating force consists of three shifts of two men each, operating on a 9 hour basis. This arrangement allows the day operating force consisting of the Chief Operator and one assistant to lap over 1½ hours in the morning with the night force and 1½ hours in the afternoon with the late afternoon and evening force, during which lapping periods 4 men are on duty.

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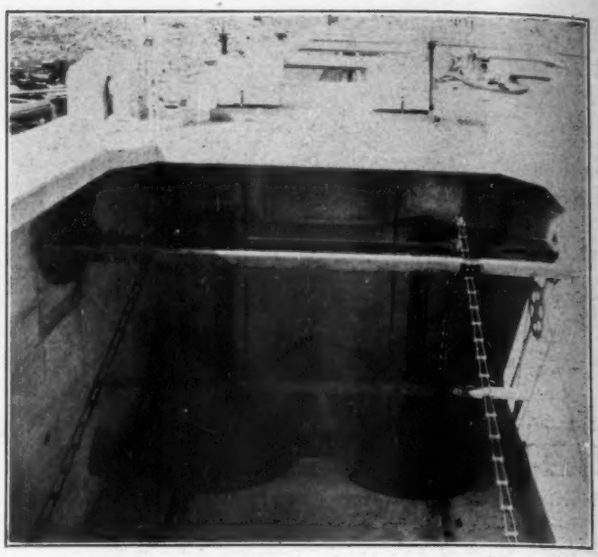

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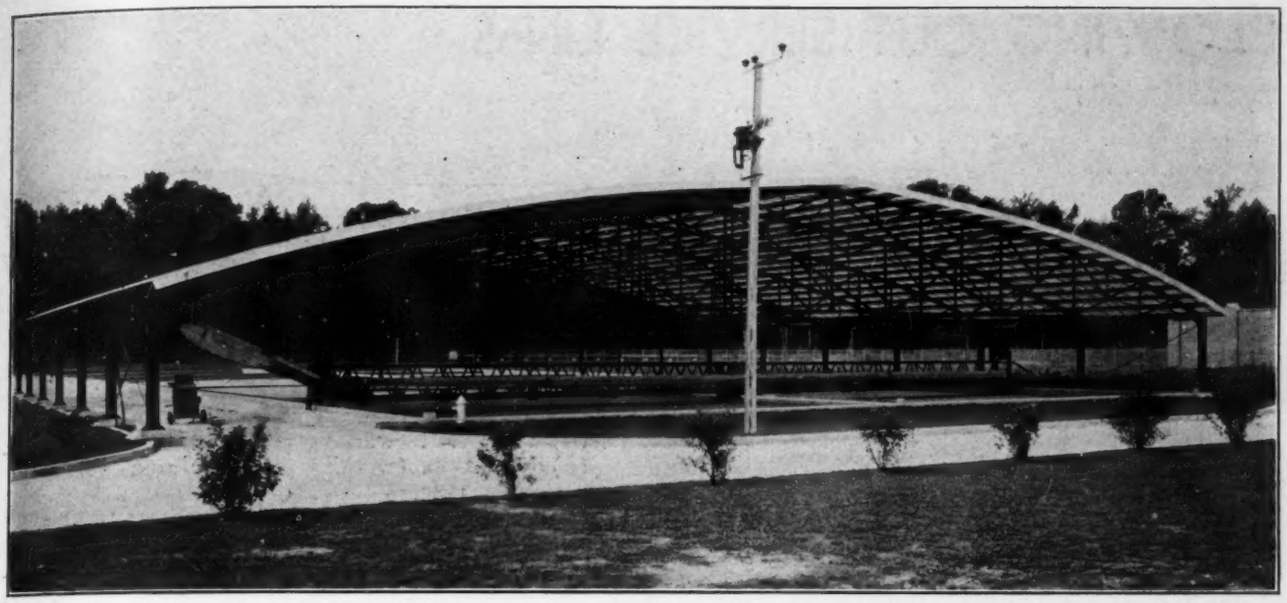

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BLOWING OUT SERVICE LINES

By S. H. DAVIS

Superintendent, Benwood & McMechen Water Co.
Benwood, W. Va.

S. H. Davis

MOST every water works operator will agree that a low pressure complaint can cause a water company to have poor, or at least "razor-edged," public relations between the affected customer and the company.

However, unless the condition is caused by insufficient main line capacity, the consumer's line, as well as the company's service line, is usually the cause of the low pressure complaint. Attempts to convince the affected customer that he should renew his lines usually brings the following question or statement: "Suppose I do renew my lines, maybe your line is stopped up between the main line and my property. How about you people doing a little digging first?" To answer that question to his satisfaction, usually means to remove meter, if located at property line or curb plot, or cut service line at curb-stop, and let him see for himself the pressure. If the pressure is poor and he sees it, he becomes very positive that he won't spend a dime until given better water pressure. He thinks it is high time that the water company correct that condition and he wants it done *right now,* etc.

Naturally, anyone responsible for the operation of a water company wants the customers satisfied, but on the other hand, he hates to dig into a paved street to disconnect a service from the corporation, or to renew the service line to satisfy the customer.

Method of Cleaning

In our two towns we have had the usual number of low pressure complaints with all the grief that goes with them. We have tried various methods of cleaning out service lines and the method we now use is the compressed air and rock salt method.

The equipment consists of the following parts:

(1) Cylinder of compressed air—*don't use oxygen.*
(2) 15 ft. 2,000-lb. wire braided hose with suitable connections to connect to service line.
(3) 1 2,000-lb. (working pressure) check valve.
(4) 1 2,000-lb. (working pressure) forged cross tee.
(5) 1 2,000-lb. (working pressure) angle valve—wheel type.
(6) 1 1,000-lb. relief valve—set at 600 to 800 lbs.
(7) 1 1,800-lb. pressure gauge.
(8) Necessary nipples to connect fittings and for connections on air cylinder (use extra heavy nipples).

The method of blowing out service lines is as follows:

(1) Make necessary test for low pressure.
(2) Fill wire hose with about 2 ft. of coarse rock salt and connect service line with curb or meter stop in the off position.
(3) Close angle valve on tank connection.
(4) Open curb or meter stop.
(5) Just crack needle valve on compressed air tank and close *quickly* with one hand.
(6) Open angle valve *immediately* with other hand.
(7) Allow muddy water to blow through angle valve until water is clear.
(8) Connect up line.

It is advisable to "crack" a fire plug so that the excess air will go out through plug.

The action of the compressed air is very quick and a surging will be noticed in the armored wire hose, but after a few seconds the surging will stop and the water will flow out of the angle valve with normal pressure. As the rock salt enters the service line it literally scrapes

Dribble *Load* *Shoot* *Gush*

One That Needs Blowing; Loading Armored Hose with 2 ft. of Rock Salt; the Quick Shot of Compressed Air (Note Man with One Hand on Cylinder Valve, the Other on Release Angle Valve). Results—Plenty of Water and a Satisfied Customer.

the incrustation away from the line and the rock salt dissolves in the main line. No complaint of salty taste in the water has resulted.

This system is only recommended where lead or copper service lines have been installed. There is too much danger of rupturing a steel line which is badly corroded.

The photographs show the results of this method. The height of water above ½-inch riser pipe (30 in. above curb stop) was 3 in. only. But, after blowing out service line the height of water was 36 in. (1200% increase) indicating increased pressure and volume obtained.

We have found that after we do our part, should the pressure continue low, consumers become convinced that their piping is either corroded or too small. In most cases they will remedy their condition. We do not blow service lines from cellar to property line, because we feel that is the plumber's job.

The average time required to attach the equipment and blow out a service line is only 15 minutes, and the average cost per blow (material only) is approximately 35 cents. Our cost for a cylinder of air is approximately $2.50.

L. I. Sewerage Conference Holds Field Day Association Meetings Scheduled:

Laurence L. Luther, Secy.-Treas.

The Long Island Conference of Sewage Works Operators and Officials, which has petitioned the New York State Sewage Works Association to be taken in as a Section of the Association, held its 3rd quarterly meeting on September 25th, at Bethpage State Park, Farmingdale, L. I.

A feature of this meeting was the Field Day held in the afternoon in which a base ball game, an old-fashioned tug-of-war and a horse shoe pitching contest were staged between teams drawn from members representing the Counties of Suffolk and Nassau. During the afternoon refreshments in the form of the "stuff" Ben Bernie advertises was served between innings.

A dinner meeting followed at Bethpage Park Country Club—a millionaire's country club built and operated by the New York State Park Commission for the use of the general public. The meeting was presided over by Honorary Chairman, W. Fred Welsch, Engineer of the Park Commission, who was introduced by Lawrence L. Luther, Superintendent of Public Works, Freeport, L. I., an organizer of the conference and its able Secretary-Treasurer.

A message of greetings from M. M. Cohn, President of N. Y. S. S. W. A., was followed by an address by Prof. Earle B. Phelps, recounting a few "Reminiscences of a Sewage Works Operator." Richard H. Gould, Chief Engineer, Department of Sanitation, New York City, presented "Greetings from the New York City End of Long Island." "Sewage Disposal Methods at Long Island States Parks" were explained by Sidney Shapiro, Deputy Engineer, L. I. State Park Commission. Chas. C. Agar, Sanitary Engineer, New York State Department of Health, reviewed experiences with "Sanitation Problems During and After the Recent Up-State (N. Y.) Floods," and by lantern pictured the aftermath in the flooded areas. For the heroic assistance rendered by W. and T. engineers during and after the flood, he was high in his praise.

L. H. Enslow, Editor, WATER WORKS AND SEWERAGE, made a brief talk on the "Meaning and Importance of Sectional Sewage Works Conferences," in which he complimented Secretary Luther and Program Committee Chairman, W. Donaldson, on the remarkable showing of the recently organized L. I. Conference and its turn-out of 60 members and guests at the Bethpage Park meeting.

The meeting was adjourned at 10:30 P. M.

The Suffolks Vs. the Nassaus

An Argument with the "Ump"—Then Refreshments. The Tug of War and More Refreshments. Who Won? We Don't Know; They Are Still Arguing

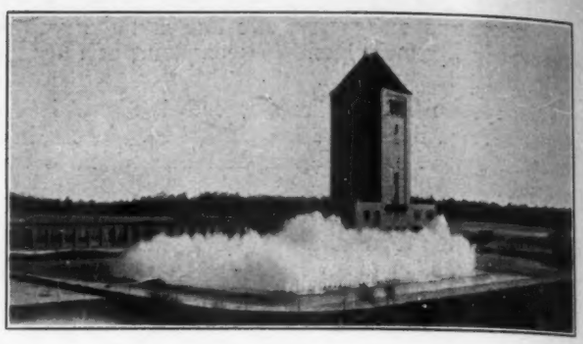
Chapman Valve-Pelton Consolidation

An agreement has been completed between Chapman Valve Manufacturing Co., Indian Orchard, Mass., and Pelton Water Wheel Co. of San Francisco, Calif. (a subsidiary of Baldwin Locomotive Company), which involves an interchange of patents, manufacturing facilities and sales efforts on valves for water works purposes. This arrangement also consolidates the engineering and research facilities and data of both companies.

The Pelton Water Wheel Co., established in 1880, is the only manufacturer on the Pacific Coast producing a complete line of hydraulic equipment. Their line includes butterfly valves, needle valves, surge suppressers, and free discharge valves for all forms of hydraulic service.

The Chapman Valve Mfg. Co., manufacturers of valves since 1874, has by various consolidations and agreements during the past few years, added to its line the product of several other manufacturers—notably, Coffin sluice gates, foot valves, etc.; automatic cone and altitude valves previously manufactured by the Automatic Cone Valve Co. of Mattoon, Ill., and the "Non-Slam" (tilting disc) Check Valve, on which Chapman controls patents in the United States.

The new connection with The Pelton Water Wheel Co. gives to each company a complete line of special and standard equipment for waterworks and sewerage plants.



Raw Water Aerators and Filtration Plant, Providence, R. I.

54TH CONVENTION OF THE NEW ENGLAND WATER WORKS ASSOCIATION

At Providence, R. I., on September 17th and 20th was held the 54th Annual Convention of the New England Water Works Association. The official registration of 650 was somewhat below that of the 1934 convention at Boston but in quality the 1935 convention was outstanding.

In addition to the excellency of technical program and the 54 exhibits of equipment and materials, the committees on entertainment had arranged an outstandingly attractive program. To W. J. (Bill) Orchard, C. C. Getchell, Chas. L. Pool and Mrs. Pool, as Committee Chairmen, in charge of entertainment and local arrangements, is due the credit.

Award of Honors

Honorary Membership was bestowed upon Frank E. Winsor, Chief Engineer, Metropolitan District Water Supply Commission of Boston, Mass., and Stephen H. Taylor, Superintendent of Water Works, New Bedford, Mass.—both having at one time served as president of the association.

To Karl R. Kenniston, Assistant Chief Engineer, Boston Metropolitan District Water Works Commission, was awarded the Dexter Brackett Medal for his paper on "Boston's Metropolitan Water Supply Extensions"—voted the most meritorious paper which had appeared in the N. E. W. W. A. Journal during the past year. In receiving the medal, Mr. Kenniston said that he felt that this honor should be credited to the organization which had made the project and paper possible, rather than to himself as an individual.

Special Awards to Superintendents

To eighteen members went special certificates in recognition of "faithful service as Superintendent, Registrar or Commissioner of Water Works during a continuous period of 25 years or longer." To the credit of those who received these Service Certificates stands, likewise, a record of membership in the association covering a quarter of a century or longer.

In years of service to a single community, Fayette F. Forbes, a member of the association for 50 years and Superintendent of Water Works at Brookline, Mass., for 60 years, headed the list. William P. Molis, Sr., a member for 48 years and Superintendent of Water Works at Muscatine, Ia., with a 59-year tenure of office to his credit, was a close second.

The names and records of those honored follow:

Name—Community	*Years' Membership*	*Years' Service*
Arthur E. Blackmer—Plymouth, Mass.	27	33
Jas. W. Blackmer—Beverly, Mass.	..	43
A. W. F. Brown—Fitchburg, Mass.	48	52
Leland G. Carlton—Springfield, Mass.	28	29
Fayette F. Forbes—Brookline, Mass.	50	62
Patrick Gear—Holyoke, Mass.	25	38
David A. Heffernan—Milton, Mass.	33	45
Howard M. King—Springfield, Mass.	28	30
Horace Kingman—Brockton, Mass.	42	42
Samuel H. MacKenzie—Southington, Conn.	32	27
Wm. A. MacKenzie—Wallingford, Conn.	27	25
Wm. P. Molis, Sr.—Muscatine, Iowa	48	59
John W. Moran—Gloucester, Mass.	34	51
William Naylor—Maynard, Mass.	30	30
Owen E. Parks—Westfield, Mass.	31	42
Leonard C. Robinson—Concord, Mass.	31	29
Percy R. Sanders—Concord, N. H.	28	28
Ernest J. Titcomb—Leicester, Mass.	25	25

Howard M. King, Springfield, Mass., Retiring President

Roger W. Esty, Danvers, Mass., Incoming President

Important Resolutions Passed

Following an address by Col. W. T. Chevalier, in which he reviewed developments in Washington, affecting water works construction as work relief projects under PWA and WPA, the important resolution below was offered and unanimously passed by the association. Copies are to be forwarded to President Roosevelt, PWA and WPA officials at Washington. A movement is under way to secure a similar resolution through the American Water Works Association for like handling. The end sought is that of impressing upon the Administration the desirability of making a portion of WPA funds available for water works projects of a major and lasting nature rather than spreading them thinly and uneconomically—and, we might add, politically.

The resolution, in part, follows:

WHEREAS, many communities now are in need of improved water works facilities and are willing to proceed with their construction, using federal aid under the Public Works Administration regulations that have prevailed hitherto, and

WHEREAS, the revised regulations as to wage rates, total expenditures per man hour, number of skilled workers and

Stephen H. Taylor, New Bedford. Made Honorary Member

Frank E. Winsor, Boston. Made Honorary Member

selection of supervisors are not conducive to the selection and installation of trustworthy materials and equipment or the employment of sufficient competent workers and supervisors to insure sound workmanship, and

WHEREAS, if these regulations were amended many thousands of competent workers now unemployed would find employment on such projects and in the production and installation of such materials and equipment, and

THEREFORE, Be It Resolved, by the New England Water Works Association, assembled in annual convention, that the President of the United States be requested and urged to establish suitable regulations to govern the administration of federal aid to non-federal water works projects so as to insure:

a. The prosecution of many such projects now available or readily made available in hundreds of communities,
b. The employment of competent engineers, supervisors and workmen on such projects regardless of whether they are on relief rolls and in proper proportion to insure first-grade workmanship.
c. The purchase and installation of materials and equipment on a basis of quality and performance that will insure trustworthy operation of such facility and full protection for each community against failures of structures or equipment that might endanger the health or safety of its people.

Business Meeting

Frank J. Gifford, Secretary, reported a loss of membership of 57 and a gain of 49 during the year, the present membership being 779. Total receipts for the year had been $10,112 and advertisements in the Journal had yielded $2,774.

L. G. Carlton, Treasurer, reported that the association's assets now amounted to $18,668, of which $17,079 represented invested funds—mostly deposits in savings banks. Gordon M. Fair, Editor, reported that the four quarterly issues of the Journal had cost $4,780, which represented a per member gross cost of $6.08. The net cost had, however, been but $1.70 per member and that this cost could be materially reduced by discontinuing the practice of issuing 50 free reprints to each author.

D. W. Foster (Chairman), reporting for the Finance Committee, recommended discontinuance of the practice of issuing free reprints to authors in order to effect a saving of approximately $500 per year in Journal expense. The committee also recommended dropping its $300 annual contribution to the New England Engineering Societies. Both recommendations, after some discussion, were unanimously approved by a vote of the association.

Robert Spurr Weston, reporting as Chairman of Committee on Water Works Schools, said that 22 members had attended the 3-day school held at Portland, Me. He expressed appreciation for the material assistance of the Portland Water District and recommended that such schools be continued and extended from 3 to 5 days, which represented the opinions of those attending.

Officers Named

The following officers were reported elected or continued for the ensuing year:

President—Roger W. Esty, Supt. of Water Works, Danvers, Mass.

First Vice-President—Harry U. Fuller, Chief Engr., Portland Water Works District, Portland, Me.

Second Vice-President—Warren J. Scott, Chief Engr., Connecticut Department of Health, Hartford, Conn.

Treasurer—Leland G. Carlton, Registrar, Water Department, Springfield, Mass.

Secretary—Frank G. Gifford, Manager, Water Company, Dedham, Mass.

Assistant Secretary—Adelaide M. Ullian, N.E.W. W. A. Headquarters, Boston, Mass.

Directors—George A. Sampson, Percy A. Shaw, H. K. Barrows.

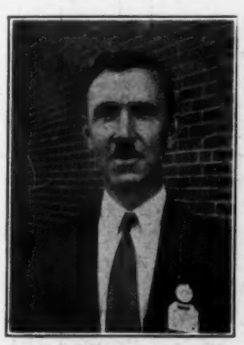
Technical Sessions

(President Howard M. King presiding.)

"Recent Developments in Connection With the Providence Water Works"—By PHILIP J. HOLTON, JR., Supt., Scituate Reservoir Division, Water Department, Providence, R. I.

Mr. Holton told of improvements to the Providence water supply system during the past 18 months, and of projected improvements. Recent construction included a new booster pumping station, fed by dual power lines, to strengthen the fire service on the high pressure system. Equipped with motor driven units of 4 and 6 M.G.D. capacity and a gasoline engine driven unit of 10 M.G.D. capacity, the new station had replaced the older and less effective Bath St. station (now a reserve station) and incidentally had brought about a reduction in power charges of $1,300 per year. The new station was capable of supplying 15,000 G.P.M. during a 10-hour period with depletion of city reservoir storage by not more than 25 per cent capacity. Other recent improvements to the distribution system included the laying of 22 miles 6 to 36 in. pipe, involving "looping" to eliminate 238 dead-ends, with the intent of improving water quality and reducing the cost of flushing and bleeding.

On the 16 square mile watershed area surrounding Scituate Reservoir an extensive 10-year reforestation program had been initiated early in 1933. The program called for the planting of 16 million evergreen trees on 11,100 acres. To date 1,700 acres had been cleared and 1,900,000 trees had been planted on 850 acres. Fourteen of the fifty miles of roadways, to serve as fire stops and to facilitate fire fighting, were now under construction. A tower 100 ft. high erected as a fire



Karl R. Kenniston, Boston. Dexter Brackett Medalist

C. C. Getchell, Bristol, R. I. Chairman of the Local Entertainment Committee

Left to right: Malcolm Pirnie, Consulting Engr., New York City; Charles A. Maguire, Commissioner of Water, Providence, R. I.; Philip J. Holton, Jr., Superintendent Reservoir Division, Providence, R. I.

lookout post, had proved its value in reducing fire damage to less than one acre the first year, as compared with 440 acres the year previous.

Losses of purchased planting stock and cost of replacements had brought on the decision to establish a 220-acre nursery at Scituate, with a 2.5 million young tree capacity. (Those making the trip of inspection to the filtration plant and reservoir were shown the 2 acres of seed beds containing the first crop of 1,500,000 white spruce and red pine seedlings.)

An improved operating schedule of the city hydro power station, making use of water daily let down the river from Scituate by legal requirement, had resulted in a record power production of 7.1 million K.W.H., making the station yield a net profit, from the $27,024 sales of electric current during the past year, for the first time.

"Treatment of the Providence (R. I.) Water Supply"—By ELWOOD L. BEAN, Chemist, Water Department, Providence, R. I.

Mr. Bean, in commenting on the quality of the Scituate water, said that the bacterial content of the raw water gave no concern. The problem was the removal of organic stain (color), iron and manganese, and adjustment of pH to check corrosion and prevent depositions within the mains and distribution system. In the beginning alum had been used, but, to eliminate manganese and iron and control corrosion, iron and lime had been used since August, 1931. To increase coagulation efficiency, the ferrous sulphate was later oxidized by chlorine to produce chlorinated-copperas. With the subsequent availability of a ready prepared ferric-sulphate ("Ferrisul"), at a price comparable with copperas and chlorine, this newer coagulant has been employed during the past two years. The procedure found most effective involved continuous dry feeding of the "Ferrisul" to a small solution tank receiving warmed water (1 lb. iron salt to 2 lbs. of water) and injection of this solution to the raw water conduit ahead of the aerators. Between the aerators and mixing chamber a lime emulsion (from dry feeders) was being added to raise the pH value to between 9.6 and 10. There was but slight reduction in the high pH value during passage through the large coagulation basins and the filters, and the plant effluent was consistently held to pH 9.6 or slightly higher.

The improved ferric-iron coagulation with lime had produced a non-depositing and non-aggressive water with an average hardness of 25 ppm. In the dead-ended areas of the distribution system the iron taken up by the water had been but 0.018 p.p.m. compared with 8 times that figure when a water of pH 7.6 had been delivered. The lead content of tap samples had been reduced barely more than a trace—approximately 0.0045 p.p.m.

Examination of the filter sand after three years of the iron and lime treatment (pH 9.6 to 10) had disclosed but a slight coating of sand grains. For taste and odor removal only once had it been necessary to resort to the application of 0.4 to 0.6 p.p.m. of powdered carbon just ahead of the filters. Considerable benefit had come from taking the raw water from the lowest intake level of the reservoir—less than 20 ft. above bottom and 60 ft. below surface. Its coolness, freedom from algae, and its iron and manganese content, which are effective in reducing the coagulant dosage required, all had added to the desirability of this unusual but effective practice of taking deep water, which at times was actually void of dissolved oxygen.

"Progress in Supplying Less Corrosive Waters"—By MALCOLM PIRNIE, Consulting Engineer, New York City.

Mr. Pirnie, designer of the local filtration plant, cited the developments in treatment at Providence as an example of modern efforts to render filtered waters passive; and, thereby, subject to minimum of pipe attack and degradation of quality of the finished product during its travels to the consumer's tap. To this problem, he said, increasing attention was deservedly being given by water works authorities.

Experiences had pointed to the fact that slime accumulations in mains, and bacterial growths harbored therein, had been responsible for the drop in pH noted in far reaches of distribution systems (especially in dead ends), and the resultant red-water or black-water troubles. The increase or decrease of 20 degree organisms, rather than pathogenic forms more generally tested for, had served as an index when successful attempts at water degradation and corrosion control had been accomplished. Inauguration of ammonia-chlorine treatment, at Providence and elsewhere, to carry residual chlorine to essentially all troublesome points on the system, had revealed the benefits of biological control in suppressing corrosion. He cited the experiences at Utica, N. Y., in which ammonia-chlorine treatment had been effective in correcting attack on a long supply main and subsequent friction creating depositions of iron oxide at points beyond. Apparently a biological phenomenon, the usual corrosion and depositions had been essentially eliminated by the disinfection procedure and, thereby, the carrying capacity of the mechanically cleaned main had been sustained. At Providence, before the change from alum to iron and lime, the estimated iron dissolved from the mains was roughly 12,000 lbs. per year as compared to something less than half a ton per year since.

At Palm Beach, Fla., since an increase in lime application to maintain a pH of 9.0 to 9.7 in the filtered water and the change in chlorine application to maintain a slight but positive residual, the iron pick-up during passage through the mains had been checked despite the fact that the water temperature often ran higher than 90 deg. F.

Observations by Mr. Pirnie, in regard to the stabili-

Left to right: D. A. Heffernan (Milton, Mass.), No. 1 Round Tabler; W. J. Scott (Hartford, Conn.), 2nd Vice Pres.; Harry U. Fuller (Portland, Me.), 1st Vice Pres.

Snapped at Scituate Filtration Plant

zation of waters, had led him to conclude that, when dealing with very soft waters, the finished product should have a pH of 9.6 to 9.8, wherein all of the alkalinity is present as the normal carbonate. Iron content should not exceed 0.05 p.p.m. and manganese should be absent at consumers' taps. Residual chlorine should be present throughout the distribution system, to control growths of 20 degree organisms and check degradation and resultant corrosion, even though not otherwise needed.

Pipe Line Capacity Losses— Actual vs. Theoretical

"Report Committee on Coefficients of Friction in Pipe Lines"—By ELSON T. KILLAM, Associate, Alexander Potter, Consulting Engineer, New York City.

Mr. Killam, Chairman of the Committee on Friction in Pipe Lines, presented in abstract the report of his committee. [The report, in full, may be found in the September, 1935, issue of the Journal of the N. E. W. W. A.—Ed.]

Mr. Killam explained that the objective of the committee was the assembling and publication of heretofore unpublished data, revealing observed friction coefficients of unlined, tar-coated Cast-Iron pipe with particular reference to the expected as against the actual coefficients observed. Also the study of the effect of water quality upon tuberculation and the rate of capacity losses was another objective. Reasonable care had been taken in making use of the data collected to eliminate non-precise material. From the data selected, "trend curves" had been prepared to reveal the actual relationship between age of pipe (years of service) and the observed coefficients as observed in the field, under practical working conditions, rather than through the laboratory type of observation.

Throughout the studies the coefficient values, referred to the "C" in the Williams-Hazen formula, because such values would be found directly proportional to the loss in carrying capacity of the pipe in that a main whose "C" had dropped 50 per cent (from 130 to 65) had also lost 50 per cent of its capacity. For supply and transmission mains of size 16 inch and larger, the value of "C" for new tar-dipped pipe had been assumed most nearly correct if taken as 135. For distribution mains less than 16 in. diameter, with allowance for Ts, valves, bends, etc., the most correct value of "C," as judged from all data available on new pipe, seemed to be 125.

Using the widely accepted Williams-Hazen tables, revealing *predicted* age-coefficient relationships (trends of "C"), such trends were plotted on cross section paper for comparison with the *actual* observed trends taken from the data submitted to the committee. The data represented 473 tests made in 19 different cities under a variety of conditions. Data on lines above and below 16 inch diameter were handled separately. The results could be summarized as follows:

(1) The larger (supply) lines in 9 cities showed a capacity loss, after 30 years, of 37 per cent as compared with a predicted loss (Williams-Hazen Curve) of 30.8 per cent.

(2) Distribution mains in 10 cities, however, showed a loss of 64 per cent in 30 years, as against the predicted loss of only 37 per cent.

From the observed findings it seemed evident that the Williams-Hazen predicted losses in capacity, with years of service, apply chiefly to large diameter mains carrying relatively inactive water, and must not be assumed to apply to average conditions—particularly to distribution mains receiving an aggressive filtered water.

A study of the effect of water quality (alkalinity and pH values) revealed a marked relationship between pH values and loss of main capacity to the following extent:

pH Value of Supply	Approx. Average Per Cent Capacity Loss of Tar-Coated C.I. Pipe 30-Year Service
8.0	30
7.5	35
7.0	45
6.5	60
6.0	85

Concerning centrifugal cement-lined pipe, the data presented to the committee indicate the average reliable value of "C" for new cement-lined pipe of 4 to 24 inch diameter to be 134, based on original diameter, and 150 if based on the diameter after lining. Both values must be considered in evaluating pipes less than 24 inch in diameter. Limited data on modern cement-lined pipes after years of service had indicated "C" = 136 after 10 years. Another line showed no loss in capacity after 10 years of service. "C" = 104 was found to apply to an old style cement-lined 12-inch W. I. pipe after 41 years of service.

Concerning values on Bitumastic enamel lined pipes, the data revealed "C" = 155 on the average (with 145 the minimum) for new lines larger than 16 inches. On distribution lines, less than 16-inch diameter, on the average "C" = 145, with 140 the minimum. The values had been computed on nominal diameter of the unlined pipe. The few years of service of centrifugal lined Pitumastic pipe rendered data collection on it futile. However, no deterioration of a hand brushed lining had been observed after 16 years of service. The report also

William F. Sullivan, Pres., Pennichuck Water Co., Nashua, N. H.

Horace J. Cook, Supt. Water District, Auburn, Me.

Seen at the Superintendents' Sessions

(1) *Charles J. Crump, Peabody, Mass.;* (2) *Francis L. Hatch, Kittery, Me.;* (3) *Harold L. Field. Greenfield, Mass.;* (4) *Patrick Gear, Holyoke, Mass.;* (5) *William Naylor, Maynard, Mass.;* (6) *Hugh McLean, Holyoke, Mass.;* (7) *Wm. A. MacKenzie, Wallingford, Conn.;* (8) *W. Guy Classin, Leominster, Mass.*

referred to progress being made in the application of cement on Bitumastic linings to pipes in place.

In correcting pH values of water to check corrosion, the report stated that the effective pH value must be determined for the particular water involved. The important element was the total calcium bicarbonate content (temporary hardness) of the water. For example, a water with a calcium bicarbonate alkalinity of 190 p.p.m. would become non-aggressive when a pH value of 7.2 was reached. On the other hand, a water of 15 p.p.m. alkalinity required that its pH value be boosted to 9.3 for a like effect.

Studying the effect of main cleaning to restore pipe capacity the data, from 24 tests reported, had revealed an average value of "C" = 39 before cleaning could be increased to "C" = 104 by cleaning. Following cleaning, the value of "C" had dropped at varying rates dependent upon size of main and character of water. Cleaning of mains could be counted upon to restore 85 per cent or more of their original capacity, judging from the data at hand.

In summing up the situation as revealed by the committee's studies, Mr. Killam said that "upon the basis of the average data on tar-coated C. I. pipe, it is found that in 19 cities the average value for "C," after 30 years' service, was only 64, as compared with a value of 88 predicted in the widely used Williams-Hazen tables. Expressed otherwise, the value of "C" had dropped to 88 after only 11 years of service instead of after a predicted period of 30 years. Furthermore, the above figures involve relatively large mains, whereas in 8 out of 10 systems the value of "C" for distribution mains, after 30 years' service, was less than 50. This involved an actual loss of capacity of from 61.6 to 84 per cent as compared with a predicted loss of only 37.5 per cent.

The vast financial loss resulting from such observed rapid capacity losses of pipe systems was in the committee's opinion a matter of extreme importance to the water supply industry and warranted a more universal checking up of main capacities by municipalities and water companies, as the basis for the adoption of the most practical preventative measures, whether these be the provision of permanent linings, corrective treatment of the water, or both. The committee recommended that a joint committee be formed with the American Water Works Association and that the studies be continued and extended in scope.

Malcolm Pirnie, in discussion, called attention to the comparative corrosiveness of coagulated and filtered waters. Since the Williams-Hazen tables and fromula had been based on observations in a previous day when chemical treatment of water had not gained popularity, this situation probably explained the rather marked discrepancy between the predicted values of "C," with increasing service, and those actually prevailing when dealing with treated or untreated waters.

E. K. Wilson, Chief Engineer, Pitometer Company, cited actual observations on 24 and 15 inch mains to prove the need for further studies along the lines started by the committee.

Clinton Inglee, President, National Water Main Cleaning Company, felt that the figure showing the recovery in pipe line capacity resulting from main cleaning, which was set forth in the report as an 85 per cent recovery, must have been derived from faulty or very old data. Present day guarantees called for a restoration of 95 per cent *or better* of the original capacity of mains when cleaned by modern methods.

Professor Gordon M. Fair, Harvard University, agreed with Mr. Pirnie's explanation of the failure of the Williams-Hazen coefficients to apply with filtered water. He cited the close agreement between predicted and observed pipe depreciation when the comparison had been confined to supply mains carrying raw waters. He thought the report directed attention to the importance of increased study of water treatment to minimize corrosion and tuberculation.

W. J. Scott, Chief Engineer, Connecticut Department of Health, pointed out that in New England, where waters were particularly soft, it was particularly important to employ some form of anti-corrosion treatment regardless of whether the water was filtered or not.

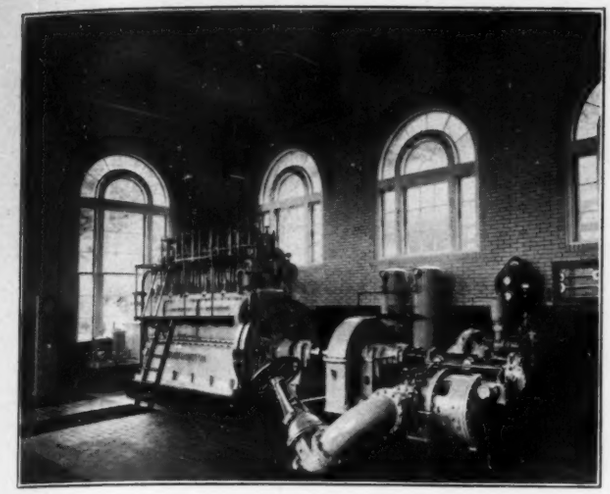
W. W. Brush commented on the surprising lack of demand for pipe protected by cement or bituminous linings, not more than 10 per cent of the pipe sold being so protected. The real question to be considered was the cost of corrosion vs. protection.

Superintendent's Session

The Superintendent's Session was opened with a paper by H. J. Cook, Superintendent, Auburn (Me.) Water District, which related the costly fight against repeated petitions from a group of influential suburban property owners to the Main Public Utilities Commission for water service involving main extensions. Such an extension would cost in the neighborhood of $100,000 to serve only 40 takers from whom an income of only $300 per year was assured. The latest attempt of the petitioners had been to secure W. P. A. assistant in renewed effort to secure the Commission's order. If successful, such would necessitate an increase in the general water rates to carry the project. Whether sought or not, Mr. Cook had many sympathizers in his audience of fellow superintendents and managers.

An Unusual Accident

A sad experience, in which three water works employees of the Augusta (Me.) Water District met their death in a deep manhole, from asphyxiation, was disclosed by Sidney S. Anthony, Supt., of the Water District. The investigation revealed the cause to be the presence of marsh damp (carbon dioxide), contributed by decaying organic matter, and oxygen deficiency. Two



The New Diesel Driven Pumping Unit, Nashua, N. H. 250-HP. Diesel Engine, 6-M.G.D. Centrifugal Pump, Eliminates Stand-by Charge; Fuel Cost, $2.25 per M.G.

men died as the result of attempted rescue of the first. Mr. Anthony said that a fourth man owed his life to a safety line which had been forced on him before he entered the manhole. The experience had proven the wisdom of testing atmospheres and ventilating the deep manholes before entering, and likewise the need for taking precautionary measures which would make rescue possible. Gas masks in such cases would prove useless because of oxygen deficiency. An analysis of the air in the manhole showed it to contain 20 per cent carbon dioxide and deficiency of oxygen. Surprising was the quickness with which the men became helpless.

"The Remodeled Pumping Station and New Diesel Engine at Nashua, N. H."—By WM. F. SULLIVAN, President, Pennichuck Water Co., Nashua, N. H.

Mr. Sullivan told of improvements in standby pumping facilities provided at Nashua. After a study, Metcalf and Eddy, Engrs., had recommended the installation of a Diesel driven 6 M.G.D. pumping unit which had been placed in the coal room of the steam standby station. The steam pump had been retained and one boiler converted to an oil burning unit.

The engine selected was a 5 cylinder Worthington 250 H.P. Diesel Engine (400 r.p.m.) driving a 6 M.G.D. Single Stage Worthington Pump at 1300 r.p.m. through Farrel-Birmingham speed increasing gears. Starting equipment comprised two Worthington air compressors and air tanks charged to a pressure of 250 lbs., each being good for four or five starts per full charge. The pump selected was a 10 in. double suction Worthing Single State centrifugal rated to deliver 4200 g.p.m. against 160 ft. dynamic head and equipped with a Skidmore water jet air eductor for automatic priming and prevention of air binding. A Smith Roto-Valve (automatically operating) was installed on the pump discharge line to prevent water hammer and protect the pumping unit.

Test results indicated 4700 g.p.m. (6.8 M.G.D.) was delivered against the dynamic head of 160 ft. at a pump speed of 1350 r.p.m. Fuel oil consumption of 41 gallons per M.G. of water pumped had proved less than that guaranteed and, at 5½ cents per gal., gave a fuel cost of $2.25 per M.G. pumped.

In answer to questions, Mr. Sullivan said that the unit had not been noisy, the exhaust noise being killed by a Maxim silencer. The unit had been completely satisfactory. The plug type (Roto Valve) had required some adjustment to eliminate water hammer entirely. In comparison with electric motor driven units for stand-by, the demand charge saved had been one of the principle considerations in selecting the Diesel unit. Compared with steam power, the cost of $7.00 per M.G. for coal as against $2.25 for fuel oil was another attractive feature and, above all, the reliability and quick starting features were outstanding.

A member who had recently visited the Nashua pumping station said that it was the easiest to operate one-man station he had ever been in, and Wm. Naylor, Superintendent, Maynard (Mass.), reported complete satisfaction with their Diesel unit at Maynard.

"The New Booster System of the Augusta (Me.) Water District" — by SIDNEY S. ANTHONY, Engr.-Supt., Augusta Water District, Augusta, Me.

Mr. Anthony, with the aid of lantern slides, described main betterments and the new booster pumping station and standpipe just completed in Augusta to supply better domestic pressure and fire service to the Cushnock Heights district. Because of its location the pump house had been constructed on attractive residential lines and enclosed with a white picket fence—(see picture). The service pumping unit selected was an Ingersoll-Rand (Cameron) Motorpump of 250 G.P.M. capacity, against a dynamic head of 73 feet with an 86 per cent efficiency rating. The motor was automatically started and stopped by a General Electric pressure control unit, at the standpipe, to maintain a 12 inch fluctuation in water level. The fire pump selected was a 750 G.P.M. Cameron Centrifugal powered by a 48 H.P. G. E. motor on one end of the shaft and a Buda gasoline engine on the other. The station was equipped also with a Builders Iron Foundry Chronoflow Meter and a Foxboro recording pressure gage.

Both pumps were equipped with Chapman "Non-Slam" Checks and Ross (3 in.) pilot operated relief valves on the discharge lines. The standpipe 42 ft. in diameter and 30 ft. high (300,000 gal. cap.) was supplied by the Pittsburgh-Des Moines Steel Company, all seams being electrically welded. It is connected with the booster station through a 10 inch main 2,000 ft. long. The cost of the complete installation was about $18,000 and its operating cost including depreciation would amount to about $1,000 per year. The new station went into service September 10th.

"Proportional Feeding Methods for Coagulants" —by R. P. LOWE, Builders Iron Foundry, Providence, R. I.

Mr. Lowe described the several types of automatic and manually controlled chemical solution feeders offered by Builders Iron Foundry. He explained the methods by which the rate of feed was caused to change automatically with changes in flow of water, sewage or

Cushnock Heights Booster Station, Augusta (Me.) Water District

Sidney S. Anthony, Supt. Water District, Augusta, Me.

Rudy P. Lowe, Builder's Iron Foundry, Providence, R. I.

sewage sludge being coagulated or chlorinated. He also described and illustrated remote manual chemical feed control schemes and the equipment. The automatic Ferro-Feeder for exact proportioning of ferric-chloride solution was described. For large plants a variable orifice actuated by differential head in Venturi Meter float tubes was now available, as was a valve positioning mechanism. Mr. Lowe predicted an increased practice of remote observation and control in water works and sewerage practice—including chemical feed control also.

The session closed with the showing of moving pictures of the manufacture of "transite" (asbestos-cement) pipe, its handling and laying. C. A. McGinnis, Manager of Transite Pipe Department, Johns-Manville Corporation, presented a running talk with the picture and answered questions which followed.

Superintendent's Round Table

The Round Table held on the closing day of the convention was as usual, highly interesting and enlightening. To this writer, of all of associations, the New England group stages the liveliest Round Table Discussions of any. Members enter into the discussions in a vigorous fashion and swap experiences and opinions in a very straight-from-the-shoulder manner which is always helpful, particularly to the younger and less experienced operators.

Topics for discussion were broken down into groups with a selected leader for each group to bring out and direct the discussion. The system seems to be a particularly effective one.

LEADER—Harold L. Brigham—Supt., Water and Sewerage, Marlborough, Mass.

"Coppering Reservoirs"—In this important algae control measure to preclude tastes and odors in water supply, considerable interest was shown. W. W. Brush, described briefly the methods applied by the New York City Water Department, experiences and results. E. Sherman Chase, explained the action of copper sulphate on organisms and stressed the importance of moderate systematic treatment to keep the objectionable growths under control by nipping them in the bud, so to speak, rather than making a "harvest" of a full grown crop, which would result in a temporary condition worse than that before the kill of the organisms. It was a case of one stitch in time being worth more than nine. Why?—because the vile tasting oils were in "tasteless" capsule form as long as the organisms were consumed alive. Having died, naturally, or having been "murdered" by the treatment, the protecting capsules disintegrated to release into the water so-called aromatic oils which were anything but palate tickling. In reply to a question, Mr. Chase said that it was the general theory that copper salts killed algae by destruction of the chloropthyl so necessary for their existence. When dead, the bodies and much of the copper would settle out into the bottom mud, but the oils went into solution in the water.

Donald C. Calderwood, told of a scheme used at Nashua, N. H., involving winter treatment wherein copper sulphate solution was pumped through holes cut in the ice to the bottom water.

L. H. Enslow, told of a labor saving and efficiency method of coppering which had been developed on the Los Angeles system. To obtain effective and uniform distribution and to reach the hard-to-get-at marginal areas of reservoirs the boats were equipped with "dry-feeders." Pulverized copper-sulphate was blown from the feeders over the water surface, the nozzle being directed at will. This scheme also precluded spotty applications and zone concentrations which resulted in the objectionable killing of fish when the bag towing method was used. It was much simpler than the solution spray method which had also been tried.

Elwood L. Bean, called attention to New England conditions wherein, ofttimes, depth treatment was more important than surface treatment and sufficient copper-sulphate to give the required dosage throughout the whole of the water rather than the upper strata only must be used or else some other scheme such as that used at Nashua would have to be employed.

"Collection of Delinquent Accounts"—In connection with this topic it developed that the Massachusetts law, which classes unpaid water bills to municipally owned water utilities as a lien against the owner of the property for a period of 2 years beyond the billing date, had been effective insurance against non payment for water. After due notice and attempts at collection, water rents overdue were handed over to the Collector of Taxes for collection (with interest). Partial payments, however, were always acceptable from hard pressed consumers in order to keep the collections out of the tax offices.

Leland G. Carlton, reported that the lien law had not worked out practically in Springfield, Mass., and the shut-off procedure had to be resorted to. A case at point was that of large holders of buildings owing big bills. Advantage had been taken of the fact that the water would not be shut off and that, merely by paying interest on the amount in arrears, postponement of payment could be enjoyed until the next tax payment date. Since returning to the shut-off method the collection record at Springfield had been very good. The balance due on August billing had been reduced from $4,000 to $300 and for July less than $40.00 remained uncollected as the result of shut-off warnings.

Harold L. Brigham, Supt., Water Works and Sewerage, Marlborough, Mass.

Wm. B. Duffy, Supt. Dept. of Public Works, North Andover, Mass.

Left to right: E. T. Cranch, Mgr., New Rochelle (N. Y.) Water Co.; W. C. Hawley, Engr.-Supt. Penn Water Co., Wilkinsburg, Pa.; Theo. L. Bristol, Pres., Ansonia (Conn.) Water Co.

Mr. Hockman, said that in Needham, Mass., they refrained if possible from use of the 2 yr. lien law. After quarterly billing, 3 notices were sent out during the month. Then rather than shut off they had resorted to the scheme of inserting a small orifice disc in the union on the service line to cripple the service. At first the suggested 1/16th in. orifice had been used but was found too large for the effect desired and 1/64th in. orifices were now employed. If even a partial payment on the bill was made the orifice was removed. The scheme had proved quite effective and did not carry the sting which a complete cut-off or forced collection did.

Thos. L. Bristol, Pres., Ansonia (Conn.) Water Co., said that, being a water company, they were forced to employ the shut-off after reasonable pleas by letter and a final notice at the expiration of 45 days. About $600 in unpaid bills was still outstanding on their books.

"Reservoir Areas for Recreational Use"—Mr. Brigham pointed out the moral as well as the legal responsibility of water boards and managers for the acts of employees and results from failures to adequately protect against possible pollution of the source of water supply. At Marlborough they had felt it necessary to prohibit recreational use of the reservoir areas and accordingly maintained a patrol system.

Mr. Sherman, of the Conn. State Department of Health, stated that recreational use of reservoirs and adjacent areas was discouraged by his department. There was a state law against bathing in reservoirs, but fishing (with permit) had not been illegalized in water supply reservoirs. On certain water-sheds, under control of the State Forestry Department, picnicking was permitted by the latter but the picnic area was supervised, well sanitated and also supervised by the Department of Health.

W. W. Brush, called attention to the interesting differences of viewpoints and policies between New England and other sections of the country in respect to use of reservoir areas for recreation. In the mid-west water supply reservoirs served a very useful purpose in providing recreational ground, even to the extend of bathing at points remote from the intake. There, the citizens practically demanded controlled recreational usage of reservoirs. New York City allowed fishing and boating under permit and supervision, aided by fish and game wardens and sanitary inspectors. It had been impossible to show that there had been any ill effects to the water quality. He believed that differences of opinion and policies of eastern and mid-western authorities should be prevented by an attempt at coordination and setting up of standards and recommendations covering the matter or usage of reservoir areas.

E. Sherman Chase, in reply to a question, said that he did not believe fish were necessary to maintain satisfactory water quality or biological balance in reservoirs. Asked if fish might not overcome tad-pole troubles, he said that frog breeding in reservoirs was not a problem in New England.

E. T. Cranch, Manager, New Rochelle Water Company, pointed out that aside from the question of health, it was important to realize that a water utility could be held responsible for injury to children or adults allowed or permitted to use or occupy areas owned or leased by the utility.

LEADER—W. W. Brush—New York City

"Meter Repair and Testing"—Mr. Brush described a machine recently developed for testing water meters up to 2 inch size and presented the results of a study of meter testing by a New Jersey Water Utility. The new machine had given a more accurate check on meter accuracy and it was believed that between $70,000 and $80,000 in greater billings per year would result from its use. The machine had been developed by Mr. James Williamson of New York and cost $900. In the investigation it had been found that many meters after testing at 3 rates, had passed requirements as to accuracy, but by use of the machine were shown to be inaccurate at intermediate rates and operating at a sizeable net loss when considering the per cent of the time such rates would prevail in practice. Although greater percentage errors appeared at very low rates, by comparison, the loss was greatest in dollar-values at intermediate rates.

R. H. Ellis, Water Commissioner, Newton, Mass., a strong advocate of adequate investment in meter shop facilities, reported that at Newton, Mass., they could trace a $16,000 annual increase in income to improved meter maintenance and testing.

Roger W. Esty (Danvers, Mass.), expressed the opinion that the highest importance should be attached to the larger meters—those from which the greatest revenue came. In general, he thought that frequency of testing and maintenance of a reasonable degree of accuracy was more to the point than less frequent testing to a more refined degree. For ease of frequent testing in the field, all important meters in Danvers had been equipped with a by-pass to allow ready removals for testing, with portable equipment, as frequently as considered necessary. Algae depositions in meters, resulting in over-registration, had been eliminated by copper sulphate treatment. At Danvers a careful comparison had revealed the proven worth of the oil enclosed gear train.

E. T. Cranch (New Rochelle, N. Y.), had observed that meters cleaned and returned to service had shown over-registration after six months' service which was sufficient to justify re-cleaning. They had found that the deposits ceased to increase and therefore, instead of repeated cleaning, they needed gear change to procure accuracy was the logical procedure. Returned to service the failure of depositions to increase further had resulted in sustained accuracy.

P. S. Wilson (Glen Ridge, N. J.), pointed to experience of water companies wherein the value of more frequent meter testing and more efficient maintenance than required by Public Service Commissions had been thoroughly established through the cash register. On municipal systems supported in part from taxation, there had been some question, however, as to whether or not the gain justified the added expense of more exact meter maintenance. Data with which to counter the argument was lacking as far as he had been able to determine.

"Long vs. Short Lengths of C. I. Pipe"—This discussion was designed to bring out the desirable and undesirable features of handling 16 or 18 ft. length C. I. Pipes as against the 12 ft. lengths. After the smoke

of the discussion cleared, it was apparent that in congested districts the shorter pipes could be more easily handled and economically used. In long runs and moderately curved lines or in the suburban areas the longer pipes had an advantage. The cost of the pipe per foot of line laid would be found the same for the various lengths. Less cost of jointing would result with the long pipe but there might be some wastage in cutting pipes to fit short runs. From a representative of U. S. C. I. Pipe Company it was learned that a 50-50 preference was being shown for long as for short pipes.

W. C. HAWLEY, Chief Engineer & Manager, Penna. Water Company, Wilkensburg, Pa., said that he uses 18 ft. length pipe whenever practicable and to avoid loss, by cutting spigot-ends, the practice is to employ all bell fittings—3 bell T's and 4 bell crosses.

D. A. HEFFERNAN (Milton, Mass.), called attention to the Builders Iron Foundry 32 deg. bends, the use of which had reduced pipe cutting.

LEADER—Wm. B. Duffy, Supt., Water and Sewerage, North Andover, Mass.

"Service Pipe—Leaks, Repairs, Cleaning"—Mr. Duffy reported that records revealed that leak repairs to old service lines in Andover had been necessary on 5 per cent of the services annually. The trouble was most usually found near the cellar wall. Since 1932 copper tubing had been used for all new service lines and replacement. He wished the experiences of others in this direction.

D. A. HEFFERNAN, said that Milton accounted for 81 per cent of the water passing the master meter to the distribution system, containing 90 miles of mains. Only cement lined service pipe and fittings were used—and, they lined all of it "at home." He was still a believer in the lead goose neck if properly wiped at the joint. To check for leaks, the meter readers used a geophone and the pipe was located with a wireless locater. The method had proven very successful in locating the trouble within a foot one way or the other—especially so if done at night. Repairs to services were made by cutting out the leaking section and connecting in a new piece with union and coupling. More recently he had used the new small Dresser couplings. To check the system for leakage it could be valved off and a meter connected around the valve to locate the section showing the leakage.

In years past he had not thought much of copper and brass because of the green copper stains on bathroom equipment indicating dissolving of copper by the water. He was of the opinion that cement lining had proved good for water mains and therefore it seemed also the practical solution in protecting service pipe. The new era of chemical treatment to subdue corrosion had changed the aspects of the situation and might alter his opinion as to brass, copper and other pipe.

ROGER W. ESTY, described methods employed to locate and measure leakage on the Danvers system. To secure a fair picture it was necessary to make the surveys at night and always at the same hour—about 4:00 A. M. For example, on one section the 4:00 A. M. tests showed a flow of 7 G.P.M. into the section, whereas at 11:00 P. M. it had been apparently 37 G.P.M. By repeated checking and leak survey a 225 G.P.M. (4:00 A. M.) flow had now been reduced to 84 G.P.M. and on another section 594 G.P.M. had been reduced gradually to one-half that figure. Observing sustained consumption during a rainy week led them to locate a bad main leak in a swamp crossing. In several cases he had observed cement lined service pipe from which the iron had been completely corroded away (in spots) from the outside. In replacements and repairs he had found the use of Dresser couplings and Skinner Clamps very helpful and time saving.

E. T. CRANCH (New Rochelle, N. Y.), stated that Dresser couplings had been used on service lines with complete satisfaction on lead, iron or copper. He had been surprised to find that they could be used on lead pipe.

H. L. BRIGHAM (Marlborough, Mass.), said that on 3,000 services only 23 leaks developed in 1934. Cement lined, lead lined and more recently copper tubing comprised the services. He, too, had found the iron gone and nothing but cement lining holding pressure at spots.

A. C. KING, Superintendent, Water Works, Taunton, Mass., said that all new services at Taunton were made up of red-brass through from main to meter. No flexible connection had been employed at the main and no trouble experienced. He believed in running all the way through with the same material to avoid electrolytic corrosion at the joints.

L. H. ENSLOW, in commenting upon the expectancy of service and household piping corrosion relief by chemical treatment of the water, said that there was a practical side to the matter which had not been solved. Whereas corrosion of mains could be effectively reduced with moderate treatment, the time had not come when care and thought in the selection of service pipe could be ignored. Mr. Enslow also told of a method of cleaning service lines involving the use of a charge of ground rock salt (ice-cream salt) forced through the choked service by the aid of a cylinder of compressed air. (The procedure, as described by S. H. Davis, Supt., Water, McMechen, W. Va., appears elsewhere in this issue.—Ed.)

Note: Lack of space makes it necessary to conclude this report in our next issue.—Ed.

Harry A. Faber Joins Chlorine Institute Staff

Harry A. Faber

Mr. Harry A. Faber, until recently Chemist with the Consolidated Water Company of Utica, N. Y., is now Assistant Sanitary Engineer with the Chlorine Institute, Inc., of New York City. He has been appointed to take the position formerly occupied by W. M. Bingley, who resigned to accept a position with the Dorr Co.

Mr. Faber will conduct (and assist others in) experimental work, looking toward improvements and new applications in chlorination practice as applied to water, sewage and industrial wastes. This work will continue under the general supervision of L. H. Enslow who, as its Sanitary and Research Engineer, has served the Chlorine Institute for upwards of 9 years.

Mr. Faber, who graduated as Chemical Engineer from Cornell University (1930), thereafter served with the New York State Department of Health in connection with stream pollution and industrial waste treatment studies. More recently his experience has been in plant operation, but he possesses that type of "curiosity" and industry that is the forte of the productive investigator and experimenter.

The Chlorine Institute will continue to supply equipment, chlorine, and technical guidance or assistance (without charge) to those who have problems in which chlorination may seem worthy of experimental application in laboratory or working scale tests.

The Walden, N. Y., Treatment Plant on Dedication Day, Administration Building and Gas Holder

THE NEW SEWAGE TREATMENT PLANT OF WALDEN, N. Y.

By NEWELL L. NUSSBAUMER, C. E.*

Buffalo, N. Y.

The Author

DURING the years 1931-1935, a sanitary sewer system, pumping station, sewage treatment plant, and certain storm sewers were built in the Village of Walden, N. Y., which is located about 10 miles west from Newburgh. The village is divided into two distinct water sheds. One, comprising about one-third of the area, drains into the Tin Brook; the other into the Wallkill. Before the sewerage system was built there were 21 individual outlets which discharged raw sewage into the two streams.

The first sewerage betterment included trunk sanitary sewers to intercept the outlets emptying into the Tin Brook and new laterals to serve unsewered streets. The cost of about $85,000.00, ran rather high because of the large amount of rock excavation involved. In these sewer lines the several siphons, which were required to carry the sewage under Tin Brook from the east to the west side, have worked satisfactorily. However, one which receives the waste from a silk mill has to be flushed out frequently, by means of hose nozzles provided for that purpose.

The second and third parts of the sewerage improvement program were begun in the Spring of 1934 as a P.W.A. project. These comprised sanitary and storm sewers in the Wallkill water shed, a sewage treatment plant, and a pump station on the Tin Brook system and force main from the station to the treatment plant.

Note.—This paper, prepared at the request of WATER WORKS AND SEWERAGE, was presented by the author before the New York and New England Sewage Works Associations in joint meeting at Schenectady, N. Y., Oct. 4, 1935.—Editor.

*Nussbaumer and Clark, Inc., Engineers, Buffalo, N. Y.

Pumping Station and Venturi Flume

The Tin Brook Pump Station is equipped with two American Well Works Pumps which deliver about 650 g.p.m. against a working head of about 42 ft. The force main is so constructed, however, that it functions as a siphon when full. At such times the working head is reduced to about 17 ft. during which periods the pumps operate, at higher capacities. The pumps are controlled from a wet well by mercoid switches which throw in one pump when the well is full and later the second pump if the flow is greater than the capacity of a single pump. An alternator supplied by the Sundh Electric Company alternates the operation of the pump units. Surges in the pipe lines are reduced to a minimum by the use of Lake Erie Check Valves which open and close slowly.

The flow of sewage is measured by a Venturi flume of the Parshall type, located at the treatment plant. This flume, with a 9 inch throat, has registered flows varying from 5,000 gallons per day to 1,500,000 gallons per day. There is a still-well adjacent to the flume which is connected through a 3 in. pipe with a second still-well under a Bailey Register and Recorder in the Administration Building about 70 ft. distant. The connecting pipe is provided with a water connection so that the line can be flushed out if necessary. To insure dependable flow records this line, we believe, should be flushed at weekly intervals.

Sewering the Wallkill water shed presented several problems. The lower end of Pine Street where there was an outlet into which sewers from several streets flowed, was about 25 ft. lower than the main trunk sewer in the new system. There was no available land at the point on which to construct a pump station and it became necessary to locate this station between curb lines of the street and entirely below surface. The pumping equipment, consisting of two Ames pumps with a capacity of 300 g.p.m. each, is housed in a concrete cylindrical room 16 ft. in diameter. The pumps are controlled by means of mercoid switches, connected with the wet well, which provide similar operation to that

(a) Sundth Master Control Panel for Sludge Pumps, Chlorinators, Bar Screens, Shredders, Incoming Power (b) Bailey Meter Panel for Pumped Sewage and Total Flow

of the Tin Brook Station. Solenoid operated check valves, supplied by the Golden-Anderson Co. of Pittsburgh are used in the discharge lines. The control equipment was installed by the Sundh Electric Company. Since the station has been in operation there has been trouble with sweating of pipes and condensation on the walls. Steps are now being taken to provide positive ventilation to correct the trouble.

Cast Iron Mains and Crossings

Another pump station, which had been planned, we found could be eliminated by substituting an elevated gravity line of Cast Iron pipe supported on concrete piers, the highest of which was about 24 ft. The initial cost of the two schemes proved to be about the same in each case, but the gravity C.I. line eliminated the continuing cost of operating the pumping station.

Two crossings of the Wallkill were made with sewers suspended on bridges. The pipes were supported by special hangers, equipped with rollers, whose elevation could be adjusted with turnbuckle. On the upper bridge, 10 in. Toncan Iron pipe with welded joints was used, the sections being made up at one end of the bridge and rolled through to the other. The pipes are encased in wooden boxes packed with asbestos wool, with adequate provision made to shed water from the top of the box.

On the lower bridge, cast iron pipe 12 inches in diameter was employed. Anthony Joints were used and Dresser Conplings connections were inserted to serve as expansion joints. The pipe was hung on hangers of substantially the same design as those used on the upper bridge.

There was considerable difficulty experienced in installing the sewers because the village had very incomplete records of existing sewers and water mains. Consequently, locations and grades of sewers as originally designed had to be frequently altered to conform with conditions encountered. We emphasize the value of adequate, accurate records of all underground structures in any community.

Treatment Plant

The treatment plant provides primary treatment only, but sufficient area has been made available at the plant site for secondary treatment when such becomes necessary. The sewage flow in the two main and trunk lines is brought together into a single channel through a structure which converts the two flows into one with a minimum amount of disturbance.

Screens and Shredder

The combined flow passes through a grit chamber and thence through the machinery and equipment building, where a mechanically raked bar screen is located. The screen can be cleaned manually or through automatically timed raking operations. The screenings, discharged onto an apron, are delivered to a grinder or shredder. The screenings are fed slowly by hand (augmented by a water jet) when a sufficient amount has accumulated to warrant running the shredder. The ground up material is discharged into sump which also receives scum from the sedimentation tank. The contents of this sump are treated with chlorine and pumped at intervals to the sludge digester. This equipment and method does away with the storing and handling of screenings and skimmings, which in some plants has always been a serious and disagreeable problem. The combined unit, consisting of bar screen and shredder, was supplied by the Jeffrey Manufacturing Company of Columbus, O.

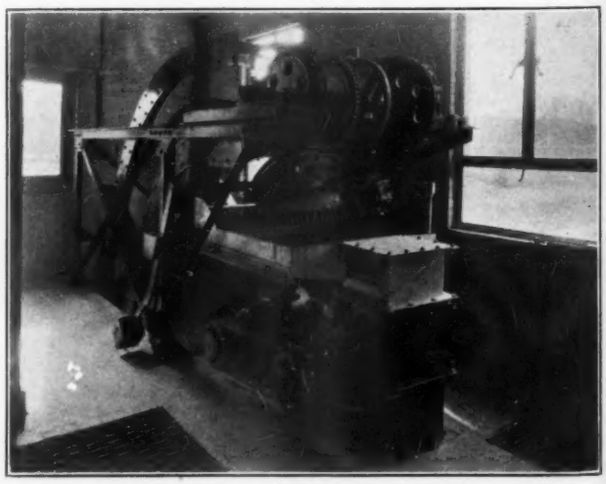
Chlorination

The sewage flow after passing through the bar screen enters the sedimentation tank through an open channel. The normal flow in this channel is about 12 inches deep. Just ahead of the sedimentation tank a by-pass around the tank to the outfall line is provided. Stop gates of Everdur metal are provided in each line. Chlorine is introduced into the crude sewage ahead of the by-pass line, so that no matter which way the sewage flows it has received chlorination. On account of the fluctuating flow from the pumping stations, and also the variations in normal flow, it was deemed economical to install an automatically controlled chlorinator which varies the amount of chlorine discharged with the volume of flow. There are two Wallace & Tiernan chlorinators at the plant, one being a stand-by machine which is only manually controlled.

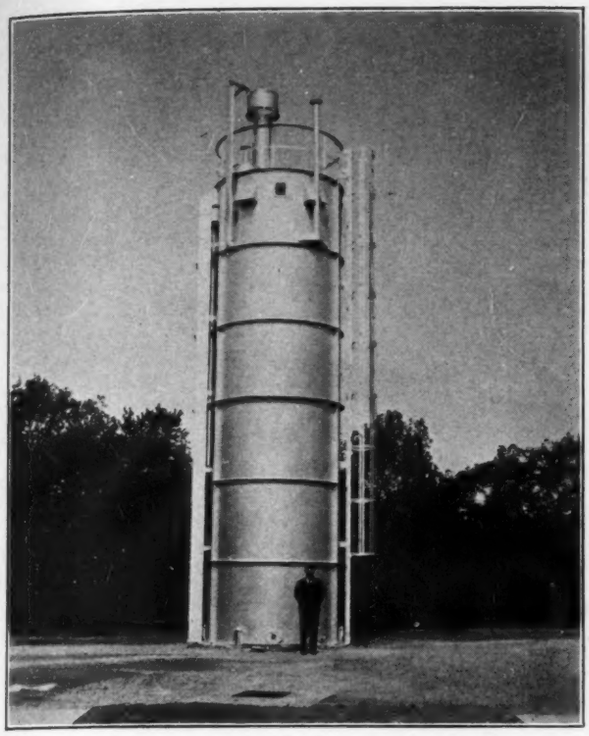
Settling Tanks

The sedimentation tank (60 ft. long and 12 ft. deep) is of the longitudinal flow type, giving from 1.5 to 3 hrs. detention. It is equipped with Jeffrey sludge collectors which are operated from a switch located inside the machinery building or from the master switch board at will. The operator runs the collector for a brief period in the morning before pumping sludge, and again in the late afternoon.

The sewage treated, includes the wastes from several felt factories which discharge materials that are difficult to settle out in the tank. Some of it floats on the surface and can be removed with the scum but some refuses to rise to the surface or to sink and is carried out in the effluent. The Imhoff cone tests show from 5-12 c.c. per liter of settleable solids in the influent, whereas



Jeffry Mechanically Raked Bar-Screen and Shredder



The Stacey-Klonne Dry-Seal Gas Holder, 2,000 Cu. Ft. Capacity, Is New to the Sewage Field

the effluent has been uniformly zero in settleable solids, but has much of the time a cloudy appearance. The chlorination is sufficient to produce a proper residual so there can be little harm produced by the effluent.

Scum and floating material is removed at the effluent end of the tank and run off through a scum trough into the previously mentioned collecting sump. The operator skims the tank each morning and runs through the shredder all of the screenings which have accumulated over night. After a short period of chlorination of the mixture, he pumps it into the digester.

Venturi Flume and Recorder

The total sewage flow is measured through Venturi Flume having a 12 inch throat and located just beyond the sedimentation tank. The operation of this flume has been very satisfactory. Where the flow is not under pressure and a Venturi tube cannot be used, this type of structure seems to offer many advantages over a weir. If a weir was used, it would be necessary to remove the plate and clean the whole channel as much more sediment would accumulate behind the plate than in the unobstructed channel of the flume. The flume is connected with a Bailey Register and Recorder located in the Machinery Building. The operator sweeps out the flume with a broom once a week to remove any material which may have clung to the concrete walls.

Sludge Pumps

Sludge from the sedimentation tank (160 cu. ft. daily average) is scraped into the hoppers by the collectors and removed by pumping. The two sludge pumps are the Rex plunger type, supplied by Chain Belt Company of Milwaukee. Each has a capacity which may be varied from 75 to 250 g.p.m. For the last two and a half months the sludge in the digester has been re-circulated between one and two hours each day by these sludge pumps. There has been little or no clogging of the pumps.

Digester Copper Coil Equipped

The digester is a cylindrical concrete tank 30 ft. in diameter and 21 ft. deep with a hopper bottom and holds about 11,000 cu. ft. There are three supernatant take-off pipes, from as many different levels in the tank, which discharge into the influent sewer line.

The inside of the digester is equipped with hot water heating coils constructed of copper tubing to insure high heat transfer, durability, and freedom from leakage.

The pH of the crude sludge has varied from 7.0 down to 6.4. At present, lime is being added through a Wallace & Tiernan Type B dry feeder, which is connected into the discharge of the recirculating sludge pumps. Sludge digestion has been proceeding very satisfactorily.

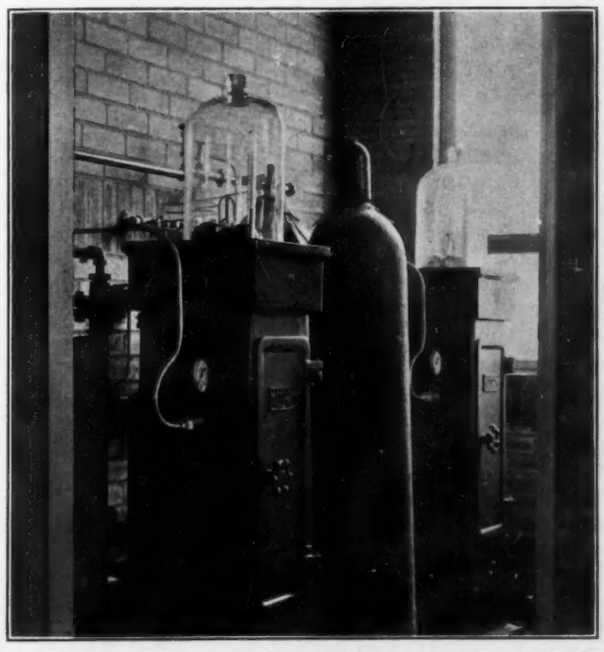
Sludge Beds

The total area of the glass enclosed sludge bed is 3,000 sq. ft. The enclosure was installed by the Hitchens Company and is provided with top and side ventilated sash. Quarter turn valves of the Nordstrom type, which were used on the sludge outlet pipes, facilitate operation greatly. The under drainage system in the beds consists of Metro Tile Blocks produced by the Metropolitan Paving Brick Company for filter beds. These blocks effect quick drainage and we believe will give very little trouble from clogging. Provision has been made for flushing out the system if necessary. Dried sludge will be removed by loading into an industrial dump truck operating on a track which leads outside of the glass housing to a sludge loading pit into which trucks can back in, and have their bodies level with the ground.

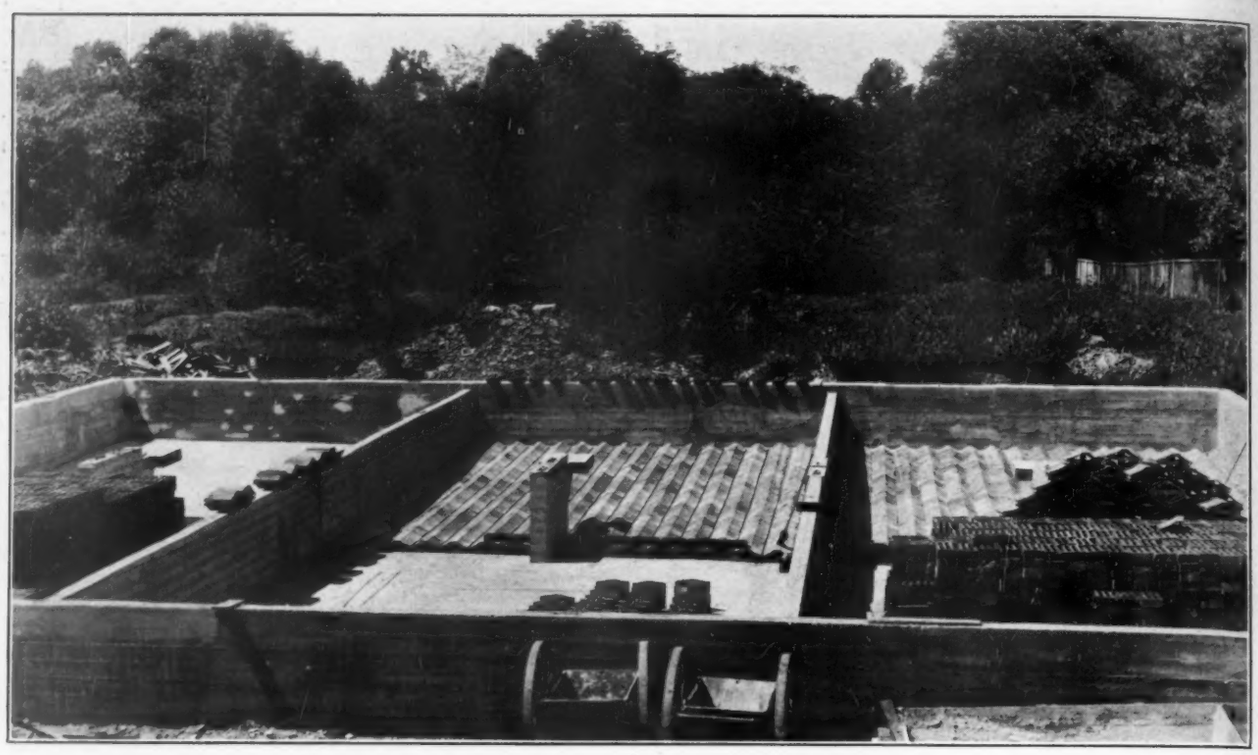
Gas Holder of Dry-Seal Type

The digester is equipped with a small gas dome from which the gas is piped to a Stacey-Klonne dry-seal type gas holder of 2,000 cu. ft. capacity, which was supplied by Stacey Brothers Gas Construction Co. of Cincinnati, O.

Considerable difficulty has been experienced in cold climates with wet-seal holders and in any case they are not very beautiful in appearance, particularly when the upper shell, which becomes rusted or discolored by the liquid seal, is exposed. The Walden plant is located on a portion of the Village Park and every effort was



Two W. & T. Vacuum Chlorinators Provide Pre-chlorination. One Is a Full Automatic Machine; the Other Manually Controlled



Sludge Bed Construction—"Metro" Tile Block Underdrain System

made to make the plant as attractive as possible. The dry-seal gas holder, painted with aluminum paint, presents a highly pleasing appearance. About 400 cu. ft. of gas have been collected in the holder up to the present time. The upper shell works easily and the working pressures seem to be properly balanced, there being about 7 inches of water pressure.

The gas holder floats on the line from the digester to the heating boiler, and serves as an equalizer and provides reserve storage in case of trouble. The gas hot water heater is equipped with a flame trap and waste burner supplied by the Pacific Flush Tank Company. Thermometers are provided in the flow and return lines of the system and a small circulating pump provides positive re-circulation.

The controls for the various pumps, and equipment are all mounted on a switch board on the ground floor of the Machinery Building. The Bailey flow recording instruments are located at the same place, and the record for the thermometers is located in the laboratory. This arrangement gives the operator of the plant a chance to observe and control most of the variables in the plant from a central point. The laboratory contains sufficient equipment to permit the making of those tests required to supply data required for the State Department of Health reports.

A small locker room, shower, and toilet room is provided for the convenience of the operators. We believe such facilities should be included in every plant.

Throughout the plant in places where corrosion is liable to occur, Everdur Metal has been used. Although the cost of the product is higher than steel, we believe its use is justified. Baffles, manhole steps, and similar parts made of Everdur have shown little or no effect from exposure to sewage.

In practically all sludge lines quarter turn Nordstrom valves have been used. These valves reduce effort in operation to a minimum and where space is restricted are especially valuable. No clogging of valves has been observed to date.

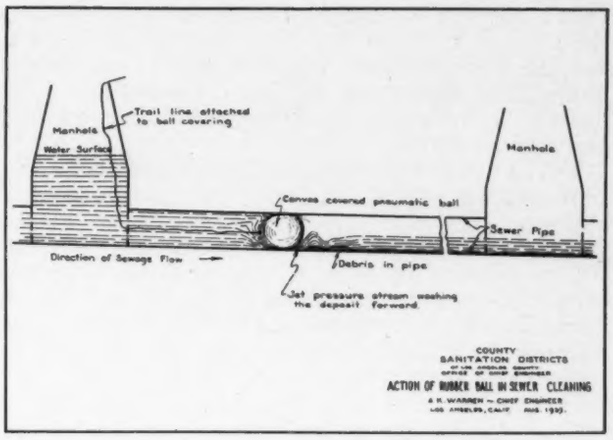
We have had one experience which leads us to speak in favor of by-passes around pump stations, and other structures where the maintenance of continuous flow depends upon the operation of mechanical equipment. The Pine Street pumping station suffered a power failure during a storm. The sewage backed up in the trunk sewer and overflowed the first manhole. If a by-pass had been permitted around the station, no worse condition would have been created from a health standpoint and there would have been no inconvenience or damage to the property owners.

The flow through the plant to date has averaged (normal days) about 250,000 gals. per 24 hours. All of the storm sewer and roof connections have not been removed from the sanitary sewers, and accounts for flowage of 550,000 g.p.d. on some rainy days.

The period of operation to date has hardly been long enough to justify conclusions or recommendations as to altered designs which may be found to suit the conditions encountered more adequately or economically. We believe, however, that the treatment provided will prove adequate in eliminating the former nuisance in Tin Brook and the Wallkill. Conditions have, in fact, already improved greatly along the streams during the past summer.

The operation of the plant is under the Department of Public Works of which Mr. Richard Baird is Superintendent. Mr. R. F. Ranner has acted as operator since the opening of the plant.

The total cost of contracts 2 and 3 will be about $280,000, the sum of $200,000 being paid by Walden and about $80,000 received as a grant from the P.W.A. Mr. Z. B. Phelps, Jr., acted as resident engineer during construction and Mr. Maxwell Gold was resident engineer inspector for the P.W.A.



Sketch of Action of Beach Ball During Sewer Cleaning

SEWER CLEANING WITH RUBBER BEACH BALLS

By A. M. RAWN, C. E.*

Los Angeles, Calif.

A. M. Rawn

DURING construction of the sewer lines of the Los Angeles County Sanitation Districts, the problem of cleaning sand and debris from newly constructed lines gave rise to the trial of pneumatic rubber beach balls for this purpose. The use of beach balls was the outgrowth of the usual trial and error methods of using pull through devices, sluicing, use of fire hose and the like.

The experiment developed into such an easy method of sewer cleaning that its use has been adopted in the regular routine cleaning practice by the operation and maintenance department. Because it is believed to be a new departure possibly in maintenance and operation of sewers, the method is herein described.

What is termed a beach ball in this narrative is the ordinary type of commercial pneumatic rubber ball commonly used at play grounds, at beach resorts and otherwise. The rubber is thin and the ball can be blown up to varying degrees of inflation at will. As furnished commercially, the balls have no covering and consist simply of elastic rubber. These balls are manufactured in sizes (diameters) of 6 to 30 inch diameter when fully inflated.

*Asst. Chief Engr., Los Angeles County Sanitation District, 139 No. Broadway, Los Angeles.

Here, is described an ingenious, practical, simple and money saving method of cleaning sewers which attracted our interest when last visiting the Los Angeles County's Sewage Works. At our request, the author, who has direct charge of the system, agreed to reveal this valuable "Kink" in maintenance and operation to the readers of Water Works and Sewerage.

In a near future issue Mr. Rawn will be found the contributor of a second article which will deal with other "Kinks", which should be highly appreciated by operators and superintendents of sewers and treatment works.—Editor.

Procedure

For use in cleaning sewers the ball is first inflated and then wrapped in a covering of canvas or burlap, the edges of which are sewed together. A trail-line a little longer than the distance between manholes is then attached securely to the covering. The size of the ball and its covering should be such as to fit fairly snugly into the sewer leaving the downstream side of the manhole.

Immediately the ball is kicked into the pipe, sewage commences to back up in the manhole and continues to increase in depth until such time as its pressure is great enough to force water *under* the ball. (See sketch.) The ball then commences to move downstream through the pipe. Acting as a compressible floating plug it affords enough obstruction so that a continuous high velocity jet spurts under and to some extent around the balls, thereby sluicing all movable material ahead to the next manhole.

Should the ball encounter an obstruction which is immovable (for instance a joint fin or the like), it merely indents to the necessary degree and moves forward. About the only fixed obstruction which will stop the forward progress of the ball is a root mass or some similar obstruction tightly wedged into the pipe. Brick, stones, bottles, loose metal parts, broken pieces of pipe, sand, gravel and settled sludge are easily moved ahead.

If the ball stops momentarily, a pull on the trail-line is usually sufficient to set it again in motion and if the pipe is quite dirty the trail-line can be snubbed to a step in the upper manhole and the ball's progress retarded to the required degree as the lower manhole is approached, thus giving time for complete removal of accumulated debris which the sewage has piled up ahead of the ball.

Much time may be saved by conserving the sewage pressure-head as the ball floats into the lower manhole.

Just as the ball comes into view at the lower manhole, the snubbed trail-line is cast off and as the ball floats into the lower manhole with the gush of sewage, it is immediately kicked into the lower (outlet) pipe. The trail-line is picked up by fishing for it and the work proceeds as before.

Obviously such a method of cleaning will not remove roots but the writer can testify that it will wash out almost any movable object or material which can find its way into the sewer. If the ball becomes lodged in the line between manholes, it may be punctured by using sewer rods and working from the lower manhole, thus permitting its withdrawal in deflated conditions upstream. In ordinarily dirty lines three men are employed as a crew and have cleaned in excess of four miles of sewer pipe in an eight hour working day.

The canvas covering serves two purposes: it permits ready attachment of the trail-line and also affords a measure of protection against puncture by razor blades, glass and sharp metal particles in the sewage sediment. The operation and maintenance crew carry along inner tube vulcanizing patches and small holes in balls are readily repaired on the job without much loss of time.

A Real Test

As a measure of the utility of this method of cleaning, one outstanding example will be noted. A 24-inch diameter reinforced concrete pipe inverted siphon carries the sewage of one main under the Los Angeles River flood control channel. The siphon is about 800 feet in length. A ball, with trail-line attached, was inserted in the upstream end of the pipe; and, although, it took thirty-six hours to work its way through, there appeared ahead of it about a truck load of sand, gravel, bricks and boulders as well as a half-dozen flash boards which had dropped into the sewer at the upstream gate. The ball was put through again immediately and appeared at the outlet in less than an hour.

For cleaning sewers not exceeding about 30 inches in diameter, the writer considers that, for ease of operation and minimum equipment, expense and effort, the beach ball procedure when properly operated is the most practical scheme he has yet observed. Its application is credited to Harry Chapman, foreman of operation and maintenance with the Los Angeles County Sanitation Districts.

CORROSION CONTROL WITH A MARBLE FILTER

By HENRY RYON*
Albany, N. Y.

A MARBLE filter, for treating the water supply of the Creedmoor Division of the Brooklyn State Hospital (4,000 pop.) was installed during the past year and the plant put in operation on July 10, 1934.

The Author

The water supply is obtained from drilled wells about 600 ft. deep in the Long Island sand and gravel. The water is lifted from the wells by deep well turbines and discharged into a 1,000,000 gallon covered concrete storage reservoir from which the high lift pumps deliver it into the distribution system consisting of some 6 miles of cast iron pipe, varying from 12 to 6 inches in size, much of which is not coated. A standpipe is provided for equalizing the flow. The present water consumption varies from 550,000 to 800,000 gallons per day.

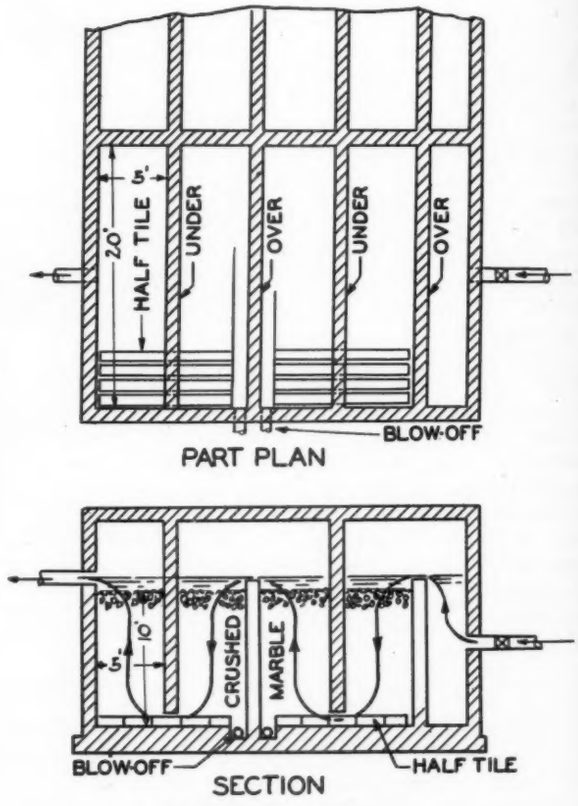
Water Quality

Considerable trouble has been experienced at the institution due to red water and to the corrosion of the service pipes in both the cold and hot water lines.

The following analysis of the well water, made in December, 1932, shows it to be a very soft and corrosive water of low pH value and high carbon-dioxide content:

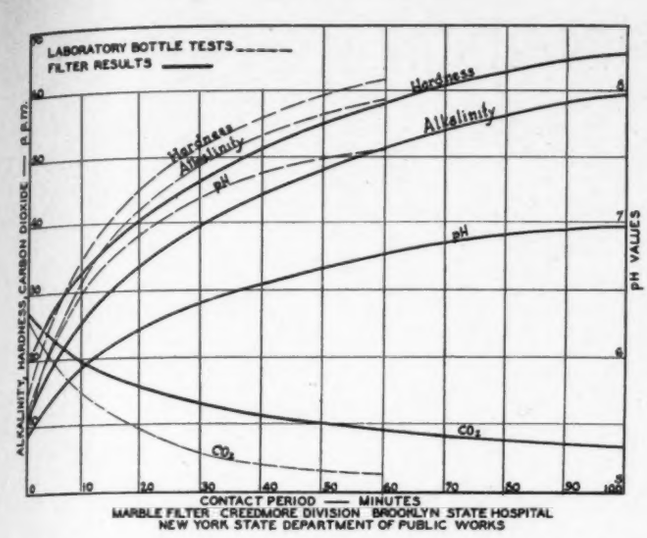
Carbon dioxide	26 p.p.m.
Dissolved oxygen	1 p.p.m.
Hardness	13 p.p.m.
Alkalinity	10 p.p.m.
pH	5.4
Temperature	57° F.

There was some gain in dissolved oxygen and loss



Marble Contact Bed and Filter

*Senior Sanitary Engineer, New York State Dept. of Public Works.



Effect of Various Contact Periods Between the Water and Crushed Marble or Limestone

of carbon dioxide in passing through the reservoir but due to the intermittent pumping and other causes this was irregular and it was impossible to trace satisfactorily the change in the quantity of these gases throughout the system. There was, however, a consistent rise in the pH of the water at the extremities of the system. At the dead ends of two lines, where there is little flow, values as high as 7.0 were observed.

In order to reduce corrosion it was obviously necessary to reduce the carbon dioxide content and raise the pH of the water. This could have been accomplished by the addition of lime, but since the rate of pumping is irregular and the works are operated by the attendants at the main power plant who can give only a small part of their time to the water works, it was considered desirable to use a type of treatment that would be as nearly automatic as possible and require no laboratory control.

About five years ago the corrosion of the wrought iron and brass pipes supplying the building of a State laboratory farm was successfully checked by passing the water through crushed marble before admitting it to the pipe lines. It seemed probable therefore that it might be possible to use this same treatment in a larger system. Laboratory tests were accordingly made by allowing samples of the water to stand in contact with crushed marble and crushed limestone in one quart bottles for different periods of time. There was no measurable difference in the effect of the marble and limestone except that the limestone left more sediment in the bottles. The results of the tests are shown by the accompanying curves.

Marble Filter

The plant was designed using these tests as a basis. The accompanying drawing shows diagrammatically the arrangement of the filters. There are two filters, arranged in parallel, with the necessary valves and bypasses. Under and over baffles are provided to distribute the flow through the crushed marble. An attempt was made to avoid, as far as possible, aeration of the water while passing through the filters, as previous experience had indicated that while the aeration liberated some of the carbon dioxide it added oxygen and thereby increased the corrosion of the pipes. Provision is made for flushing out any sediment that may collect in the bottoms of the filters. The specifications for the crushed marble required that it contain not less than 99 per cent calcium carbonate and that the size be such that all pieces pass a 1.5 inch square opening and all be retained by a .05 inch square opening.

On the completion of the installation the filters were tested at different rates or contact periods. The effect of the different contact periods on the hardness, pH, and carbon dioxide content of the water is shown by the accompanying curves. The dissolved oxygen content of the water rose from 1 p.p.m. (60° F.) to 3.6 p.p.m. (60° F.) in passing through the filters.

While the treatment does not raise the pH of the water to the theoretical equilibrium point, the treatment has resulted in a material reduction in red water and has eliminated the complaints regarding stains on laundry work.

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Atlanta to Construct 54-Mile Sewer System and 5 Treatment Plants

On September 18th Atlanta citizens voted approval of three bond issues, one to the amount of $1,000,000 being for the construction of 54 miles of sanitary sewers and 5 sewage treatment plants, and a second in the amount of $500,000 for storm drains.

The $1,000,000 is to be supplemented by an allotment from the Works Progress Administration of $4,599,000 for sanitary sewerage betterments, and $2,000,000 will supplement the $500,000 voted for 10 miles of storm sewers.

For many years Atlanta, one of the earliest American communities to install sewage treatment works (three Imhoff-tank-sprinkling filter plants designed by the late Rudolf Herring and George W. Fuller), has been in great need of improvements to its long overloaded and largely by-passed disposal system.

Interesting is the fact that the structures of at least one of these early American plants is to be made full use of by a program of modernization. This involves the retaining of the old trickling filters, conversion of the old Imhoff tanks into mechanically cleaned settling units and provision of separate digestion tanks.

Chemicalization of the settled sewage by the application of chlorinated ferrous sulphate (chlorinated-copperas) will make it possible to operate the existing 30 year old filters at three times the loading permissible otherwise. The chemicalization with chlorinated iron simultaneously serves as an odor prevention process as shown by small plant scale experimental studies conducted by the Atlanta Bureau of Sewers during the past summer under the direction of M. T. Singleton of Wiedeman & Singleton, Consulting Engineers of Atlanta.

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Manufacturers Name O'Brien, Kienle, Northrup to A. W. W. A. Board

Representatives from the Water Works Manufacturers Association have been selected by the Executive Committee of that association to fill the three places in the Board of Directors of the American Water Works Association in conformity with the recently revised constitution, calling for three members from the Manufacturer's Association instead of one. Dennis F. O'Brien, who for some years has been a director, was assigned a term to end in 1939. John A. Kienle was assigned a term to end in 1938 and Guy C. Northrup will serve until 1937.

EXPERIENCE WITH CHLORINATION OF ACTIVATED SLUDGE

By E. E. SMITH
Superintendent of Water Works and Sewage Treatment, Lima, Ohio

The Author

THE operation of the Activated Sludge type of sewage treatment plant has the ever present danger of the so-called sludge bulking. Sewage literature abounds with descriptions, reasons for and treatment of this phenomenon. Recent experiences at the Lima Sewage Treatment Works seems to indicate close correlation between a marked increase in the numbers of fungus filaments in the aeration units and poor settling of sludge in the final settling tanks, decrease in dissolved oxygen in final tanks, and poor clarification of final effluent. Sludge bulking seems to be the common cause of inefficient and uneconomical operation of Activated Sludge plants.

During the summer of 1934 when sludge bulking occurred, all previously described remedies were employed—increased application of air to sewage, variation of returned sludge percentage, the employment of ferric chloride, and application of calcium hydroxide in varying amounts. All of these remedies failed to exhibit beneficial action except possibly heavy doses of calcium hydroxide. The sewage upon which these remedies were tried was, in common to most sewages of that drought period, unusually strong and high in temperature, with the consequent necessity of efficient purification during the low stream flows.

Experimentation with Chlorine

In October, 1934, Sanitary Engineer J. K. Hoskins of the United States Public Health Service mentioned to the writer some beneficial results to the process following the use of chlorine at the Cincinnati Stream Pollution Investigations Experimental plant. It was decided, therefore, to observe the effects of chlorine gas on the returned activated sludge.

The design of the Lime Sewage Treatment Works was admirably adapted for this particular experiment for the following reasons:

Activated sludge from the final tanks is brought through two separate 12 inch sludge lines from the tank sumps to a sight feed hopper where separate sludge valves control the sludge flow into a 14 inch combined gravity line conveying the sludge 95 ft. to the returned sludge sump. For purposes of chlorination this arrangement permits good mixing and a contact period (under slight pressure) of ten to twenty minutes, depending on the rate of sludge returned. The results obtained from the use of one tank of chlorine, applied without careful control, were so evidently desirable, that arrangements were made for the rental, at a very nominal sum, of a W. & T. solution feed chlorinator from a local pool. This was put into use under controlled conditions November 2, 1934.

Compiled observations during the first treatment of the returned sludge are shown in Table I. These figures are self-explanatory and it should be noted that seven days after the start of chlorination filaments were absent from the sludge. The ratio of p.p.m. chlorine applied to each per cent of solids in the returned sludge is apparently a governing factor in the action of filament removal, because results were not being obtained when that ratio was below 1.00 (shown in Table II) during the second application of chlorine. No filament removal was noted for the twelve days of low ratio chlorine dosage.

Inasmuch as the last eleven days of application of chlorine during the first experiment and the first twelve days of the second experiment seemed to indicate that chlorine applied below the apparent threshold ratio of 1.00 was without sufficient effect, a further experiment with chlorine was made at ratios of 2.00 or more. Tables III to VII, inclusive, show subsequent use of chlorine to date of writing.

At the Lima Sewage Treatment Works daily microscopical examination of the aeration tank effluent are made, as well as the usual hourly estimations of percentage of settling solids in the aeration tank effluent. From the indications of these two determinations the chlorine effected a marked reduction of the excessive numbers of filaments. Their complete removal was not attempted, nor did it seem necessary. For the volume of returned sludge and percentage of suspended solids contained at the Lima plant, the use of a single tank of chlorine applied over a period of seventy-two hours

Sewage Treatment Works of Lima, O. Right to Left: Screen House, Primary Clarifiers, Blower House, Secondary Clarifiers, Aeration Tanks, Sludge Beds. Digesters Not Visible on Left.

ACTIVATED SLUDGE CHLORINATION DATA AND RESULTS—AT LIMA, OHIO

TABLE I

Date 1934	M.G.D. Ret. Sl.	Air Cu.ft./Gal.	% S.S. Ret. Sl.[1]	Chlorine (lbs.)	P.P.M. Cl.	P.P.M. Cl.[2] % S.S. Ret. Sl.	Sl. Index	% Sludge by Volume[3]	Mic. App. (Fil. Organisms)
Nov. 2	1.656	1.60	1.20	12.0	2.54	2.12	0.42	75	######
3	1.633	1.50	1.26	36.0	2.64	2.10	0.46	75	#####
4	1.544	1.48	1.45	36.0	2.80	1.93	0.92	35	###
5	1.636	1.45	1.60	36.0	2.64	1.65	1.15	35	###
6	1.461	1.80	1.78	38.0	3.12	1.75	1.90	22	##
7	1.522	1.26	1.75	37.0	2.92	1.67	2.50	18	#
8	1.463	1.37	1.74	37.0	3.13	1.80	2.60	16	#
9	1.436	1.36	1.71	27.5	2.30	1.34	2.59	16	#
10	1.436	1.18	1.71	12.0	1.00	0.58	2.43	16	—
11	1.374	1.29	1.52	10.5	0.92	0.60	2.90	14	—
12	1.264	1.22	1.76	11.0	1.04	0.59	2.85	14	#
13	1.207	1.11	2.05	9.0	0.90	0.44	2.98	13	—
14	1.155	1.25	1.93	9.5	0.91	0.51	2.85	14	#
15	1.183	1.00	1.80	9.0	0.91	0.50	2.60	15	—
16	1.108	0.91	1.93	10.5	1.14	0.59	2.13	15	—
17	1.070	0.95	1.95	10.0	1.12	0.57	2.26	15	—
18	1.146	0.84	1.81	10.5	1.10	0.61	2.64	14	—
19	1.068	0.83	1.80	10.0	1.12	0.62	2.92	13	—
20	0.976	0.92	1.90	10.0	1.23	0.65	2.50	14	—
21	1.083	1.04	1.52	9.3	1.02	0.67	2.53	13	—
22	1.110	0.87	1.59	10.2	1.11	0.70	2.80	12	—
23	1.118	0.91	1.70	10.5	1.13	0.66	2.53	13	—
24	1.105	0.88	1.94	9.0	0.98	0.50	2.73	13	—
25	1.058	0.88	1.71	10.0	1.14	0.67	2.90	16	—
26	1.058	0.92	2.07	5.8	0.65	0.31	2.56	15	—

TABLE II

Dec. 6	0.888	0.49	2.47	4.0	0.54	0.22	2.31	16	##
7	0.932	0.76	2.36	9.5	1.22	0.52	2.64	14	##
8	0.874	0.79	2.54	9.7	1.34	0.53	2.70	14	##
9	0.958	0.90	2.60	9.8	1.22	0.47	2.66	15	##
10	0.856	0.83	2.46	9.5	1.33	0.54	2.53	15	##
11	0.857	0.79	2.73	9.0	1.26	0.46	2.64	14	##
12	0.908	0.76	2.73	11.0	1.46	0.54	2.53	15	##
13	0.919	0.79	2.85	15.0	1.96	0.69	2.82	15	##
14	0.836	0.79	2.90	14.5	2.08	0.72	2.60	15	##
15	0.904	0.91	2.68	15.0	1.99	0.72	2.58	17	##
16	1.182	0.98	2.42	14.0	1.42	0.59	2.77	18	###
17	0.880	0.92	2.40	19.5	2.65	1.11	2.66	18	###
18	0.906	0.84	2.71	22.0	2.92	1.08	2.82	17	##
19	0.912	0.83	2.59	23.5	3.10	1.20	3.00	23	##
20	0.854	0.70	2.98	24.0	3.38	1.13	2.66	15	#
21	0.829	0.64	2.59	23.0	3.34	1.29	2.66	15	—
22	0.780	0.69	3.34	13.5	2.07	0.62	2.52	14	#
23	0.867	0.72	3.17	9.0	1.24	0.39	2.33	16	#
24	0.807	0.79	3.39	9.0	1.34	0.40	2.80	14	—
25	0.888	0.75	3.36	8.5	0.96	0.29	2.64	14	—
26	0.475	0.52	3.29	8.5	2.45	0.74	2.91	12	—

TABLE III

1935 Apr. 2	0.622	2.62	2.74	13.5	5.20	1.90	2.50	20	###
3	0.783	1.52	2.18	38.0	5.82	2.67	2.57	19	###
4	0.758	1.08	2.34	35.0	5.54	2.37	2.44	18	##
5	0.802	0.81	2.81	38.5	5.76	2.05	2.54	17	##
6	0.854	0.92	2.57	38.8	5.46	2.12	2.55	16	#
7	0.823	0.82	2.64	35.7	5.35	2.03	2.55	15	—

TABLE IV

May 13	0.899	0.88	2.06	22.0	5.12	2.48	2.16	24	##
14	0.904	0.64	2.34	38.2	5.07	2.16	2.00	17	##
15	0.956	0.76	2.44	34.5	4.34	1.78	2.31	17	#
16	0.905	0.74	2.48	38.0	5.03	2.03	1.93	15	#
17	0.899	0.93	2.43	36.0	4.78	1.97	2.04	21	—

TABLE V

June 4	1.215	1.03	1.85	12.2	3.03	1.64	2.10	21	##
5	1.226	0.87	1.91	34.0	3.00	1.57	1.80	22	##
6	1.188	1.02	1.83	37.3	3.77	2.06	3.07	19	#
7	1.221	0.80	1.60	24.0	3.77	2.36	1.80	23	#

TABLE VI

24	1.057	1.00	1.47	10.5	3.58	2.44	1.40	23	##
25	1.027	1.00	1.54	34.5	4.03	2.62	1.50	23	##
26	1.049	0.95	1.56	36.0	4.12	2.64	1.40	23	#
27	0.974	0.95	1.64	23.5	4.34	2.64	1.43	23	#

TABLE VII

July 21	1.030	0.76	1.41	20.5	4.43	3.14	1.14	25	##
22	0.822	1.08	1.45	38.5	5.62	3.88	1.20	22	##
23	0.752	0.77	1.49	36.5	5.83	3.91	1.41	17	#
24	0.845	0.72	1.54	10.0	5.66	3.68	1.48	19	#

[1]Percent Suspended Solids in sludge returned; [2]Ratio P.P.M. Chlorine applied to returned sludge for every percent of Suspended Solids content by weight; [3]Hourly settling test on mixed liquor leaving aeration tanks.

seems to be an entirely satisfactory rate of dosage to the returned sludge.

Economy of the Process

About 1,400 pounds of chlorine have been used to date at a cost of $98.00. Air requirements have been reduced to little more than the delivery of the smallest size blower, without regard to variations in sewage flow. It may be estimated that air requirements, without the danger of bulking, should not exceed an average of 0.90 cu. ft. per gallon of sewage. As bulking may be eventually expected when the air-sewage ratio is reduced below 1.00 to 1.25 cu. ft. per gallon, the ability to use chlorine as above indicated will result in a gross saving (in 8½ months) of between $470 and $1,650. This is arrived at in the following manner:

Assuming the normal sewage flow of 4.50 M.G.D the cost of air compression to supply 0.90 cu. ft. per gallon daily was $17.80. For 1.00 cu. ft. per gallon was $19.65; and, for 1.25 cu. ft. per gallon was $24.30—the difference between 0.90 and 1.00 being $1.85 per day, and the difference between 0.90 and 1.25 being $6.50 per day. Multiplying these differences by 255 days (8½ months) produces gross saving of $470 and $1,650 in round numbers. Deducting the cost of chlorination, shows net saving of $320 to $1,500. These figures are based on conservative estimates, because the application of air has been as low as 0.62 cu. ft. per gal. daily average and as low as 0.78 monthly average during chlorination. Without the ability to correct sludge bulking so readily and effectively with chlorine such low applications of air would have been unwise and impracticable.

This work was conducted under the supervision of the writer, who is General Superintendent of Water Works and Sewage Treatment. The active cooperation of C. W. Prentice, Laboratory Assistant at the Lima Sewage Treatment Works and the able support of the Mayor of Lima, the Honorable Allen L. Metheany, is hereby acknowledged with appreciation.

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Morris S. Jones Now Chief Engineer and Manager Pasadena Water Department

Morris S. Jones, formerly Assistant Chief Engineer of the Pasadena Water Department, has been made Chief Engineer and General Manager. He fills the position vacated by Samuel B. Morris, who resigned to accept the chair of Civil Engineering at Leland Stanford University on September 1st.

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Los Angeles Citizens Kept Water Conscious

Los Angeles, through its Department of Water and Power, has availed itself of the opportunity to show the thousands who daily visit the San Diego Exposition how a tiny, thirsty pueblo, on the fringe of a desert has, by the ingenuity of hydraulic engineers, become the fifth largest city in the United States. How, through the development of adequate and dependable water resources, the economic security of the community has been provided.

Passing between two gigantic cascades of water the visitor enters the "Water Palace"—exhibit of the Los Angeles Bureau of Water Works and Supply. Water

Los Angeles' Water Palace

was nowhere else more appreciated in days gone by than in the arid areas of California. Los Angeles water supply authorities are doing their best to see that its Water Works continues to be considered the important utility that it is.

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Association Meetings Scheduled

Oct. 14-17—**Southwest Section A. W. W. A.** *Houston, Texas. Secy., Lewis A. Quigley, Supt., Water Works, Fort Worth, Texas. (*Former Southwest Water Works Assn.)

Oct. 14-15—**American Society Municipal Engineers and International Association Public Works Officials.** Netherland Plaza Hotel, Cincinnati, Ohio. Executive-Director, D. C. Stone, 850 East 58th Street, Chicago, Ill.

Oct. 17-18—**Canadian Institute on Sewage and Sanitation.** King Edward Hotel, Toronto, Ont. Sec'y-Treas., A. E. Berry, Chief Engineer, Ontario Department of Health, Toronto, Ont.

Oct. 17-18—**New York Section A. W. W. A.** Hotel Powers, Rochester, N. Y. Secy., R. K. Blanchard, Neptune Meter Co., 50 West 50th St., New York City.

Oct. 18-19—**Minnesota Section A. W. W. A.** Lowry Hotel, St. Paul, Minn. Sec'y-Treas., R. M. Finch, % Wallace and Tiernan Co., 416 Flour Exchange Bldg., Minneapolis, Minn.

Oct. 17-19—**Pennsylvania Water Works Association** (40th Annual Meeting.) Haddon Hall, Atlantic City, N. J. Secy., H. F. Snow, 507 Telegraph Bldg., Harrisburg, Pa.

Oct. 23-26—**California Section A. W. W. A.** San Diego, Calif., Secy., J. E. Phillips, Department of Water and Power, Los Angeles, Calif.

Oct. 25-26—**Central States Sewage Works Association.** (Annual Meeting.) Urbana-Champaign, Ill. Sec'y-Treas., G. H. Radebaugh, Urbana-Champaign, Ill.

Oct. 31-Nov. 1—**West Virginia Conference on Water Purification.** Daniel Boone Hotel, Charleston, W. Va. Sec'y, J. B. Harrington, State Department of Health, Charleston, W. Va.

Nov. 4-6—**North Carolina Section A. W. W. A.,** Durham, N. C. M. F. Trice, State Board of Health, Raleigh, N. C.

Nov. 7-8—**Virginia Section A. W. W. A.** Hotel Roanoke, Roanoke, Va. Sec'y, H. W. Snidow, State Department of Health, Richmond Va.

Nov. 6-8—**Missouri Valley Section A. W. W. A.** Fort Des Moines, Ia. Sec'y-Treas., Earl L. Waterman, University of Iowa, Iowa City, Ia.

March 23-25, 1936—**Kentucky-Tennessee Section.** Lexington, Ky. Sec'y, F. C. Dugan, State Board of Health, Louisville, Ky.

June 8-12, 1936—**American Water Works Association.** Annual Convention, Biltmore Hotel, Los Angeles, California. Sec'y, B. C. Little, 29 West 39th St., New York City.

OPERATIONS IN THE JACKSONVILLE WATER METER DEPARTMENT

By J. E. HERRING

Superintendent of Meters, Water Department, Jacksonville, Fla.

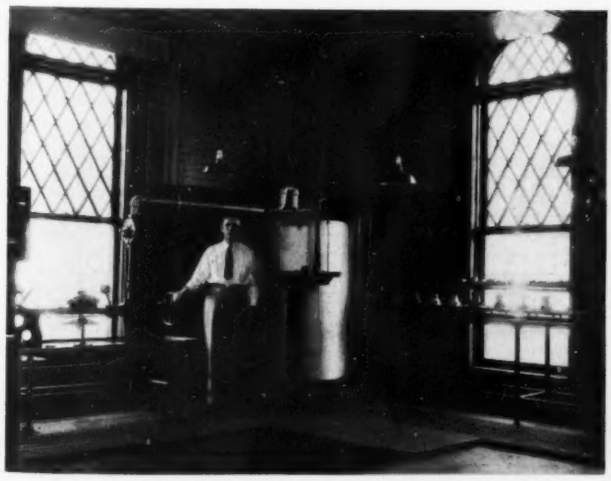
IT is that important measuring device—the meter—that tells us how much money to collect, and if your meter is not in good working condition, then your cash register is not taking in the money that it should. And, too, there are other duties which the Water Department is called upon to perform than estimating what is the proper and just amount of water to be charged for when we find the meter has stopped registering.

The department head wishes to see that his department receives what it is honestly entitled to. In this he is not asking the consumer to pay for service he did not receive but if the meter is not registering can he, with the information available, render a bill which he believes will be satisfactory to the consumer? Or, suppose that he makes out a bill which he believes to be just, but which the consumer may dispute, how will your commissioners or department heads view the matter? They may not share with the meter man the confidence in the water meter, which his experience has given him, but rather be inclined to concede the more or less general distrust of the meter so frequently shown by the public.

Meter Office and the Author

Meter Reading and Complaints

Occasionally there will be the case of a consumer who merely objects to paying the bill. He may be sincere in feeling that the bill is too high, or he may know better and just want to avoid payment of the bill that much longer. In that case we have to send out and get the meter, bring it into the shop and make a special test of that particular meter, although 98 per cent of the meters that are brought in for special test (that is because of a disputed bill) will be found to register correctly.



One Corner of the Shop, Showing Both Test Benches with 40 Cu. Ft. Tank on Scales, Between Them. Jacksonville Meter Shop

It is well to keep in mind that, as a general rule, if any question arises about the test of the meter or in making an estimated bill, the benefit of the doubt is always given the consumer.

In Jacksonville, meters are read every month, and the bills are sent out quarterly. Large consumers are billed monthly. This makes it easier to estimate a bill if we have to; and, too, if anything should go wrong with the meter the meter reader will catch it before it has gone too long. It is very important that the fact that a meter is not registering should be discovered at the earliest opportunity.

Testing Procedure

The meter readers report all meters that are not registering and a ticket is made out at the city hall for that meter to be changed. The ticket is sent to the meter

Ready-to-Serve Meter Stock. Meters Stored in Their Separate Room Have Been Repaired, Tested and Are Ready for Service. Jacksonville, Fla., Water Department

shop, where a crew takes charge of the ticket and installs another meter in place of the one that is not registering. This meter when brought into the shop is cleaned out and checked over thoroughly, and all the worn parts are replaced with new ones. Then it is placed on the test bench where three tests are made as follows: 1/6 inch stream with 5 cu. ft.; ¼ inch stream with 10 cu. ft.; open flow with 10 cu. ft.

This test applies to the ⅝ and ¾ inch meters which are tested in series of ten whereas the larger meters are tested singly. We have two Mueller test benches, one of testing in series of ten and one for single testing. We have one forty cu. ft. tank set on scales that takes care of both test benches. The discharge pipe from the test bench to the tank is equipped with a quick operating valve and is so arranged that it will remain full of water at all times.

Every meter before it leaves the shop for service must register at least 97 per cent and not over 99½ per cent correct. This is done to give the consumer a slight benefit on his side of the ledger.

Frequency of Testing

We change meters only when they are not registering or when there is a disputed bill—broken dials and glasses being repaired on the premises. I do not think it necessary nor economical to periodically test meters, especially the small meters. I made an investigation of this in 1930 and found that it was not advisable from an economical standpoint.

I have one man in the shop who repairs and tests all meters and two men who work out from the shop change all meters that are not registering, and make necessary repairs that can be done without bringing the meter to the shop. About every thirty days the office will furnish me with a list of meters at vacant houses that have been vacant for some time. The meter crew takes the list and brings in all those meters and they are all checked over and tested. Any meter that will not come up to the required test and that I think will cost too much to repair is junked.

Maintenance and Repair Practice—Costs

We have about thirty thousand meters in Jacksonville, and it is a very easy matter for one man to take care of the repairs required on them. About all of our meters now have the enclosed oil gear trains and those that have not are immediately changed over when they reach the shops. We have very little trouble with the gear train, but we do have some trouble with the measuring chamber and disc. Some of them we can repair and some of them we send back to the factory to be reconditioned and fitted with new discs. We have them fitted with new discs because they can make a better fit at the factory than we can at the shop. The job, complete, is very reasonable in cost and at the same time the chambers are electro tinned, and I consider the chamber then almost as good as a new one.

We sometimes get a meter that has the disc warped. This of course is caused from hot water backing up to the meter, and there are only two remedies for this, one is to have the consumer install a check valve on his line and the other is to replace the cold water disc with a hot water disc. I find that we have some wear on the disc

METER RECORD

Meter No. 1031636	Make Worthington	Size 5/8		Received 1934	
St. Address 2925 Downing St.			Tap Size 1"	Tap No.	30110
Location of Tap 90'E.E.Willow Branch-6'S.N.Downing				Service Size	3/4"
Date Set 12/5/32	Reading -0-	Plumber		C. R. No.	2497
Date Out	Reading	Cause		C. R. No.	
St. Address			Tap Size	Tap No.	
Location of Tap				Service Size	
Date Set	Reading	Plumber		C. R. No.	
Date Out	Reading	Cause		C. R. No.	
St. Address			Tap Size	Tap No.	
Location of Tap				Service Size	
Date Set	Reading	Plumber		C. R. No.	
Date Out	Reading	Cause		C. R. No.	
St. Address			Tap Size	Tap No.	
Location of Tap				Service Size	
Date Set	Reading	Plumber		C. R. No.	
Date Out	Reading	Cause		C. R. No.	

METER TEST

Date	Test Before and After Adjusting 10%	100%	Dial Reading	Reason for Test	Cost of Repairs Material	Labor	Tester

Front and Rear of Office Meter Record Card. Jacksonville, Fla., Water Department

ball, also in the ball seat of the chamber. This can be taken up quite a bit, if you have a three piece disc, by taking off the half ball and inserting a thin piece of paper between the disc and ball.

We have very little trouble with the register—and this, mostly at times when a consumer has quite a large excess bill and somehow the register will have the appearance of having been smashed with a hammer. In this case the consumer is sent a bill to cover the cost of a new register.

I think the meters in Jacksonville are in better condition now than they have ever been, and the cost per meter per year for maintenance is about four cents. This, however, does not include labor.

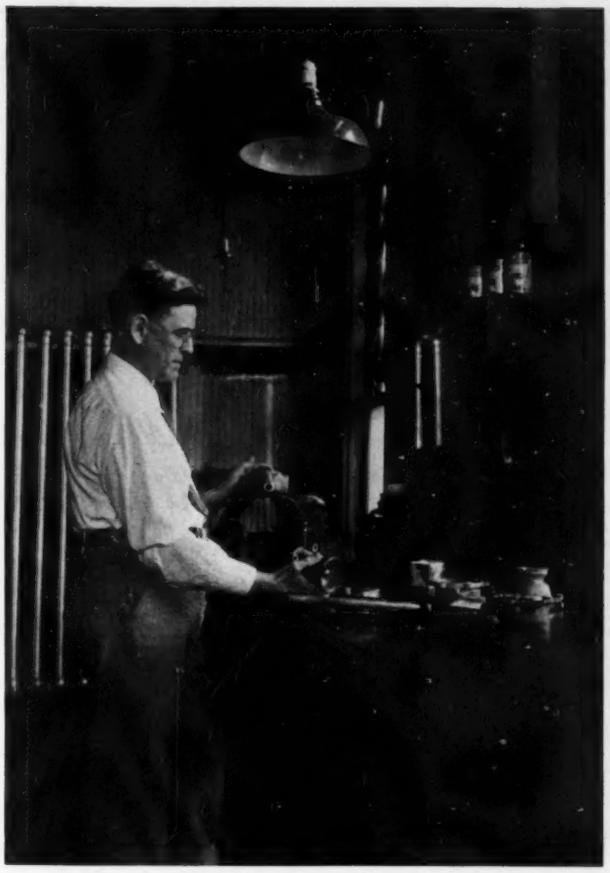
Special Crew Tests Large Meters

We have one crew of two men who take care of the large meters of which there are one hundred and one in sizes from 3 to 8 inchs, inclusive. These meters are cleaned out and tested twice a year without moving the meter from the premises, also without interference with the consumers water supply at all. We have a by-pass around all of the large meters.

We have a 3 inch test meter of the velocity type for the large flows and a ⅝ inch test meter for the small flows. These two meters are connected to the meter to be tested with a 2½ inch high-pressure hose. The flow through the 3 inch meter being controlled by a 3 inch quick closing valve, and the flow through the small meter being controlled by a ¾ inch valve on the side of the 3 inch meter. The large meters are tested on four flows and the test meters are checked every so often to be sure that they are accurate.

Each month I receive a copy of the water bills rendered the larger consumers. This is done so that I may keep a check on how the large meters are registering and if there is a great deal of difference in the bills from one month to the next I immediately make an investigation of that meter.

From my experience with the water meter I would advise all water departments to keep a close check on all meters, especially the large meters. It pays because you can only collect what the meter tells you to bill for.



A Portion of the Work Bench, Showing Mr. Williams, Chief Repairman. Jacksonville Meter Shop

O. Z. Tyler is Superintendent of Utilities at Jacksonville and the writer is Superintendent of the Meter Department.

This paper is essentially the same as that presented by the author before the Florida Section of the A. W. W. A.

METER OUT

MAKE SIZE SEAL
NO.
READING
CAUSE
REMARKS

SHOP REPORT

DATE
RE'D BY
PARTS
LABOR
TESTED BY
OPEN LOW SEN. AVGE.
REMARKS

METER OUT

DATE
MAKE SIZE SEAL
NO.
READING
CAUSE
LOCATION
FOREMAN
REMARKS

METER SET

DATE
MAKE SIZE SEAL
NO.
READING
LOCATION
FOREMAN
REMARKS

Meter Shop Record Tag, Showing Front and Rear of Split Tag Used on All Meters Removed for Test or Repairs

▼

Wisconsin's Progress in Pollution Control Notable

Water pollution control in Wisconsin during the past ten years is worthy of note.

Municipalities have expended more than $13,500,000 on sewage treatment plant construction or improvements during the decade, while industries have spent more than $2,500,000 on waste disposal systems.

A review of sewage treatment plant projects now under construction, or about to be undertaken, shows that the liberal federal terms offered by PWA are stimulating the movement toward abatement of all water pollution in Wisconsin, at a rate hitherto unequalled.

Paper and pulp mills, whose wastes have created serious pollution problems in Wisconsin, have found that waste treatment systems frequently effect substantial savings while reducing water pollution. Canneries and milk plants are doing their part by installing treatment works, the number of which is rapidly increasing.

For the notable and outstanding progress in waste treatment in Wisconsin, recognition is due L. F. Warrick, State Sanitary Engineer.

EDITORIAL

Progressive Sewage Planning

A NOTABLE example of what may be achieved by and the general benefits to be gained in the planning, financing and operating of municipally owned utilities by bringing the water works and sewerage departments under a single management, is well illustrated in the results secured at Durham, N. C. Such results are recounted in the featured article in this issue by W. M. Piatt of Durham which should be read and re-read for the "meat" that it contains.

When it comes to the new sewage treatment works of Durham, which were made possible as a P.W.A. project because of the interlocking of the sewerage with the water works utility, one finds that a novel and highly interesting situation has developed in sewage treatment and by-product utilization. It was but a few years ago that the designer of the new Durham plant made a pioneering attempt at Charlotte, N. C., to utilize the power producing digested gas to operate engines. In this he learned the essential features of an engine requisite to make the scheme a complete, rather than a partial, success. More recently Walraven proceeded to establish the fact that most of the electric power required in the operation of the Springfield, Ill., activated sludge plant could be recovered through the use of gas engines operated on digester gas, with the heat from the exhaust gases being largely recovered and put to use in digester warming. Now one learns that continuous operation of gas engines at the Durham plant has proven completely successful. The attention commanding feature of the operation is that the whole of the power required by the activated sludge process as there used is that which is "home-made" by the gas engine driven generator sets. Intriguing is the fact, that sewage made current is, during certain periods, sent out from the treatment plant onto the city operated electric lighting system. Also, that after continuous duty for a year the engines operating on sludge gas, upon take-down for examination, looked as good as when new.

Aside from the all important power recovery features, there are many unique, novel and attention commanding features of design and equipment in the Durham plant which denote progress. One outstanding example is found in the unique system of sludge digestion control—the heart of the successful performance of the power generating station. Replacing the less effective methods of sampling sludge and gas from digesters for watching the trends in pH values and gas quality, the automatic recording bomb-calorimeter located in the laboratory draws gas continuously from the individual digesters and produces an exact record of the gas quality. Here, there is had a laboratory check-up which utilizes as the "test-tube" the digester itself, with all of its contents. A lowering of the recorded B.t.u. value of the gas indicates a dropping of methane to carbon-dioxide ratio long in advance of and more accurately than could a laboratory test on single samples of gas or sludge. The diagnosis being accurately and early attained, the "doctor" can save the patient from the ultimate ills which the calorimeter record of "pulse count" indicates to be forthcoming unless rest-cure or sludge alkalinization are resorted to. In consequence the strong heart beat of the engines is maintained without a skip. This is but one of several innovations which go to make the new Durham plant outstanding amongst modern sewage treatment plants in America.

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Kinks

IN the water works and sewerage fields the word "Kinks" becomes a descriptive and meaningful term when used in connection with the words operation or maintenance. Like "tricks of the trade" in the manufacturing field, "operating kinks" and "maintenance kinks" in every-day water works and sewerage practices have a decided value in making for simplification and economy of time, energy or cost—frequently all of them. Taken singly a kink may seem relatively unimportant and the benefits small, whereas, collectively they take on a composite value which is frequently too greatly underestimated.

To operators and managers, operating kinks are sufficiently important to warrant greater interchange of information concerning them at meetings and through technical publications serving the field. To such an end this journal makes an especial effort to procure and print articles which describe practical applications of kinks in operation and maintenance of water works and sewerage systems. In this issue two such articles appear and both of these deserve particular attention. That by Mr. Davis of West Virginia tells of a simple, effective and non-expensive method of clearing choked service lines. The article by Mr. Rawn of California tells of an ingenious use of rubber beach-balls in sewer cleaning. In past issues there have appeared several articles of a similar nature which if clipped and taken collectively would supply the make-up for a handy scrapbook labeled "Operating and Maintenance Kinks."

In future issues, articles and notes on kinks will be allotted even more space provided the desired material is procurable from operating men. This direction is that of persuading operators and managers to contribute their "bit", with a realization that the value of what they have to offer should not be under estimated by them. Contributions should be considered with the view of "give and take", with the appreciation that from the individual items, supplied by contributors independently, composited articles can be prepared in which proper credit as to the source of information will appear.

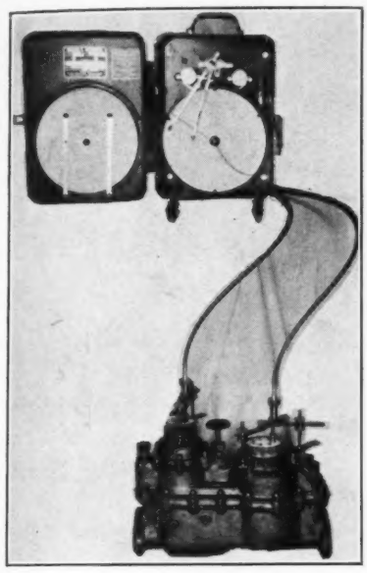
With the desire of giving its readers the fullest benefit of practical experiences of its fellow readers, let this then be construed as an invitation—a plea—from WATER WORKS AND SEWERAGE that articles, notes or letters telling of useful kinks be contributed to its pages. With that spirit of "give and take" in the exchange of ideas and information, even the benefit of items may become in composite form of great value to many. With this in mind our readers are asked to make a note on their desk reminder pads to contribute a kink or two. Better still—*do it now!*

NEW EQUIPMENT AND LITERATURE

The Meter Master

The "Meter-Master" is a rate recorder for attaching to meters of any or all makes, whether of the simple or compound type. A chart is made of the rate of flow during periods of 6 or 24 hours. The recorder mechanism and cables weigh only 17 17 pounds and therefore are readily portable. To connect it, the meter clock does not have to be removed and its record is not in the least interrupted or interfered with in making the connection.

The "Meter-Master" was developed by



The Meter-Master

a water works operator, for water works operators. Its use obviates the necessity of temporary installation of a special rate recording meter for the purpose of proving rates of draught and consumption through a service; the determination of correct size of meter for the duty; settling complaints of meter over-registration by making field tests, etc. Developed for use by the Hartford, Conn., Water Department, the "Meter-Master" has been in use there for more than three years; in New Britain, Conn., for two years and elsewhere for shorter periods. It has recently been placed on the market at a price which invites inquiry.

For literature and further details address Messrs. Brainard and Hatch, 246 Palm St., Hartford, Conn.

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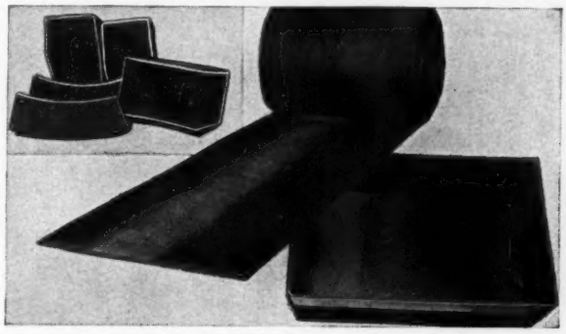
Selfvulc Rubber Coating

The Self-Vulcanizing Rubber Co. of Chicago, Ill., offer SELFVULC Rubber Compound for application in liquid or plastic form for protection of surfaces and equipment against corrosion or abrasion. Liquid Selfvulc is applied cold by brush, spraygun or dipping. Plastic Selfvulc is trowelled on. The compound contains 90 per cent pure gum rubber and, being cold cured, is guaranteed not to harden, crack or blister. It remains resilient with age and withstands heat up to 200 deg. F. and cold to 120 deg. below zero. It is especially suitable for lining tanks or covering blowers



Self Vulc Rubber Coating

and fans and is resistant to concentrated hydrochloric acid and ferric chloride.

Its qualities and many established uses in the industrial and sanitation fields are set forth in a well prepared brochure. Write for a copy.

Address—Self-Vulcanizing Rubber Co., Inc., 605 West Washington Boulevard, Chicago, Ill.

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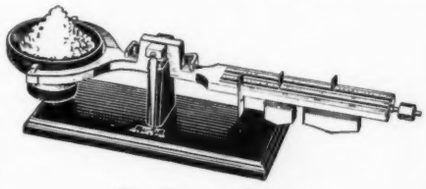
Bennett Balance

The Bennett Balance is an attractive and moderately priced scale for laboratory, plant or field use. It is compact (10¾ inches long by 3⅛ inches high) and weighs but 14 ounces. It has a capacity of 100 grams and is said to be accurate to about 1/100th gram. It has no separate



The Bennett Balance

weights, so easy to lose; is built with black Bakelite base and pan, and light alloy beam. It has no springs and looks to be a remarkable little balance for the price of $5.00 at which it is offered.

For literature and details on the Bennett Balance and other laboratory equipment, address the Chemical Publishing Company, 175 5th Avenue, New York City.

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Check Valve Shut-off Switch

The novel feature of the Hazleton Check Valve is its built-in motor shut-off switch. This mercoid contact switch is actuated by the check valve flap. When down (no water passing) the switch is open; when up the switch is closed. It is connected into the no-voltage coil of the motor starter. If the pump loses its water the drop of the flap results in an automatic shut down of the motor. For remote control the device is especially valuable in that the pumping unit cannot continue to operate, unprimed, unless the starter button is manually held down.

By making and breaking a lighting circuit, on which there is one or more electric bulbs, the Hazleton Mercoid Switch Check Valve will also serve to indicate the position of the flap. As a resultant, the rate of pump discharge may be indicated, should it be desired to change rates by valve throttling at the pumps or utilizing some method of varying pump speeds. It has a decided application in this direction in connection with pumping of sewage sludges from clarifiers or thickening tanks into digestion tanks or to sludge filters. It may likewise prove of assistance in adjusting the rates of *returned* activated sludge to areation units.

For descriptive literature, address,

Hazleton Check Valve

Barrett, Haentjens & Company, Pump Manufacturers, of Hazleton, Penna.

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WITH THE MANUFACTURERS

Foxboro Establishes British Factory

As the result of increasing British demands for Foxboro controlling, recording and indicating instruments, Foxboro Company of Foxboro, Mass., have found it necessary to establish their own office and factory in London.

A company has been organized under the name of Foxboro-Yoxall, Limited, under the management of Mr. L. S. Yoxall, who for many years has been thoroughly familiar with Foxboro instruments and service.

The British factory of Foxboro-Yoxall, Limited, is situated in Merton, the new and modern manufacturing suburb of London, with its up-to-date homes for employees.

Catalogs and Trade Literature Received

"Thorobreds and Plugs" is the suggestive cover title of a novel little booklet recently published by Columbian Iron Works of Chattanooga, Tenn. The preface states, "There is a difference" between Thoroughbreds and PLUGS." Its pages set forth, in easy and attractive style, 27 Fire Hydrant (Plug) Problems and what Columbia has done about it in developing the "thorobred." The pictures tell the story of "Trouble and Remedy" and this little easy-to-read brochure is as instructive as it is unique and attractively produced. Anyone will be interested in a copy of "Thorobreds and Plugs." Address Columbian Iron Works, Chattanooga. Tenn., or Mueller Company, Decatur, Ill.

"Iron Salts in Sewage Treatment"—A 45 page booklet produced by Wallace and Tiernan Co., brings together in reprint form four recently published articles dealing with chemical treatment of sewages. These articles by engineers and plant operators have appeared in scattered publications during the year. Being brought together under a single cover they present a fair picture of the status and possibilities possessed by chemical methods of sewage treatment. The authors are—L. H. Enslow, F. M. Veatch, H. H. Hendon and I. R. Riker. Ask for Technical Reprint No. 465—Address Wallace and Tiernan Co., Inc., Newark, N. J.

"The Automatic Magnetite Filter"—Is an easy-to-read bulletin which describes and illustrates the automatically cleaned sewage filter which makes use of the qualities of ground magnetite iron ore (magnetite) for filtration and a travelling electromagnet to automatically and continuously free the bed of the enmeshed solids strained out. A set of performance curves from published articles tells of the results from studies made to determine what the magnetite filter accomplishes in improving settling tank effluents; saving of chemicals and improvement of effluent in chemical precipitation practice; removal of activated sludge lifted into effluents from final clarifiers and possibilities of reducing air requirements. For a copy of "The Automatic Magnetite Filter" and supporting reprinted articles, address—Filtration Equipment Corp., 10 East 40th St., New York City.

"Ross Automatic Valves and Specialties"—Is a new illustrated bulletin issued by Ross Valve Manufacturing Company of Troy, New York. Reducing and Regulating Valves, Altitude and Float Valves, Dual Seated Throat Valves, Surge and Relief Valves, Dual Seated Float Valves are all effectively described and various applications noted. Hydraulic Booster Pumps for converting a larger volume of low pressure to a smaller volume of much higher pressure water for operating hydraulic valves, chlorinators, chemical feeders and the like, at any point on any system, are also featured. Bulletin 35-A is the first to be published by the Ross Company for some time and therefore brings up to date their featured specialties. Address—Ross Valve and Manufacturing Co., Troy, N. Y.

"Taste and Odor Control"—The September issue of the publication of the same name distributed monthly by Industrial Chemical Sales Company, producers of "NUCHAR" activated carbon, contains a report covering the experimental results from the use of an improved coagulant at three important filtration plants. The novel coagulant is a compounded product which is principally filter alum into which specially prepared activated carbon of high coagulating efficiency has been blended. The product known as "Black Alum" is in fact an "Activated Alum," as judged by its improved coagulation properties and economy realized. The data and photographic reproductions tell the story. Also described is an efficient procedure for making flocculation tests. Ask for "Taste and Odor Control" for September, 1935. Address—Industrial Chemical Sales Company, 230 Park Ave., New York City.

"Aeration and Filtration"—Is the third of a series of brochures of the same title which have been published by the Norton Co. of Worcester, Mass., and which set forth the properties, preparations and adaptations of Norton Porous Diffuser Plates and Tubes for air blowing in sewage treatment, chemical mixing and aeration. Address, Norton Co., Sanitation Division, Worcester, Mass.

"Pomona Pumps"—In an elaborately illustrated 40 page bulletin, Pomona Pump Company of California presents their line of deep well and turbine pumps picturing numerous actual installations and the 60 distinctive features of Pomona Pumps. "The World's Deepest Turbine" which lifts 1800 g.p.m. against 640 ft. head (intake bowls 450 feet down in the well) is described and illustrated. This and a variety of installations make up an interesting and enlightening bulletin. In the appendix are useful hydraulic tables and conversion factors. Request Bulletin 16-13. Address—Pomona Pump Company, Pomona, Calif.

"Link Belt Collectors"—Link Belt Company's new bulletin describes and picturizes its featured "Straight-Line" sludge collector and skimming mechanisms for sedimentation tanks with lengths greater than widths. Tables are presented for conversion of detention periods and flows to tank capacities and dimensions for the most efficient sedimentation. Other Link Belt equipment for water and sewage treatment plants including bar screens, fine screens, mechanical aerators, sprinkling filter distributors, grit washers, etc., are also briefly described and illustrated. Request, Book No. 1542. Address—Link Belt Company, Philadelphia, Pa., or Chicago, Ill.

"Nichols Herreshoff Incinerator"—Nichols Engineering and Research Corporation have issued a bulletin which describes and illustrates the new incinerator installed at the Dearborn, Mich., Sewage Treatment Works to burn wet sludge cake. The company is also distributing a reprinted article by M. B. Owen, which sets forth the operating results attained with the new incinerator, cost data and efficiencies. For both, address—Nichols Engineering and Research Corp., (Sanitation Department) 40 Wall Street, New York City.

Statement of the Ownership, Management, Circulation, Etc., Required by the Act of Congress of March 3, 1933,

Of Water Works and Sewerage, published monthly at Chicago, Illinois, for October 1, 1935.

State of Illinois, County of Cook—ss.

Before me, a notary public in and for the State and county aforesaid, personally appeared E. S. Gillette, who, having been duly sworn according to law, deposes and says that he is the Business Manager of the Water Works and Sewerage and that the following is, to the best of his knowledge and belief, a true statement of the ownership, management (and if a daily paper, the circulation), etc., of the aforesaid publication for the date shown in the above caption, required by the Act of August 24, 1912, embodied in section 411, Postal Laws and Regulations, printed on the reverse of this form, to wit:

1. That the names and address of the publisher, editor, managing editor, and business managers are:

Publisher, Gillette Publishing Company, 400 W. Madison St., Chicago, Ill.

Editor, L. H. Enslow, 155 E. 44th St., New York, N. Y.

Managing Editor, C. T. Murray, 400 W. Madison St., Chicago, Ill.

Business Manager, E. S. Gillette, 400 W. Madison St., Chicago, Ill.

2. That the owner is: (If owned by a corporation, its name and address must be stated and also immediately thereunder the names and addresses of stockholders owning or holding one per cent or more of total amount of stock. If not owned by a corporation, the names and addresses of the individual owners must be given. If owned by a firm, company, or other unincorporated concern, its name and address, as well as those of each individual member, must be given.

Gillette Publishing Company, 400 W. Madison St., Chicago, Ill.

Mrs. R. W. Hume, 303 S. Stone Ave., La Grange, Ill.

H. P. Gillette, 400 W. Madison St., Chicago, Ill.

E. S. Gillette, 400 W. Madison St., Chicago, Ill.

Winifred Gillette, 1125 Oak Grove Ave., San Marino, Calif.

Provident Trust Company, 17th and Chestnut Sts., Philadelphia, Pa.

Louise Forsythe, 13 E. Windemere Terr., Lansdowne, Pa.

La Verne Louer Hellyer, Ambassador Hotel, Chicago, Ill.

L. H. Enslow, 155 E. 44th St., New York, N. Y.

3. That the known bondholders, mortgagees, and other security holders owning or holding 1 per cent or more of total amount of bonds, mortgages, or other securities are: (If there are none, so state.)
None.

4. That the two paragraphs next above, giving the names of the owners, stockholders, and security holders, if any, contain not only the list of stockholders and security holders as they appear upon the books of the company but also, in cases where the stockholder or security holder appears upon the books of the company as trustee or in any other fiduciary relation, the name of the person or corporation for whom such trustee is acting, is given; also that the said two paragraphs contain statements embracing affiant's full knowledge and belief as to the circumstances and conditions under which stockholders and security holders who do not appear upon the books of the company as trustees, hold stock and securities in a capacity other than that of a bona fide owner; and this affiant has no reason to believe that any other person, association, or corporation has any interest direct or indirect in the said stock, bonds, or other securities than as so stated by him.

5. That the average number of copies of each issue of this publication sold or distributed, through the mails or otherwise, to paid subscribers during the twelve months preceding the date shown above is —. (This information is required from daily publications only.)

EDWARD S. GILLETTE,
Business Manager.

Sworn to and subscribed before me this 1st day of October, 1935.

(Seal) KITTIE C. WOULFE,
Notary Public.

(My commission expires Feb. 8, 1938.)

"Chicago" Non-Clog Sewage Pumps

Complete Lines: Horizontal, Vertical, Close-Coupled

Exclusive—

Newly Designed

IMPELLER

(Open Type)

High Efficiency

Trouble-Free Service

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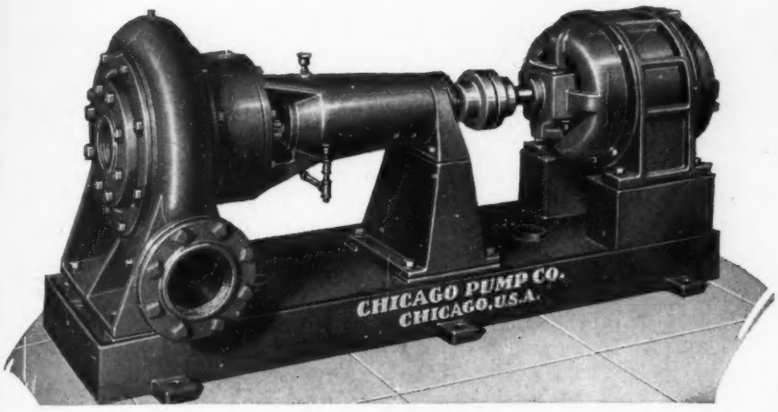

Fig. 1774—"Chicago" Horizontal Non-Clog Sewage Pump. Bearing housing and pump casing are a self-contained unit. This insures perfect alignment. Pump is mounted directly on base. This prevents long lines of pipes pulling pump out of alignment.

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SEWAGE PUMPS — "SCRU-PELLER" SLUDGE PUMPS—SEWAGE SAMPLERS—COMMINUTORS—AERATORS

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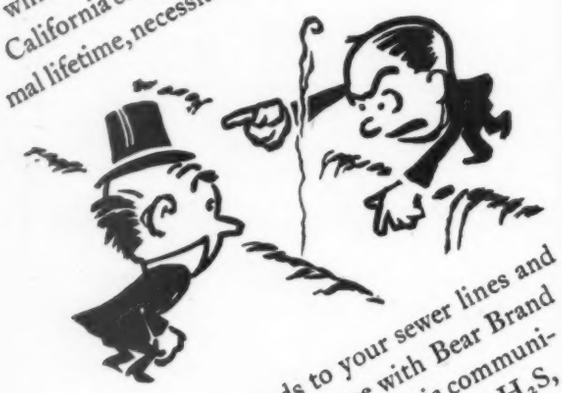
S. R. DRESSER MANUFACTURING CO. • BRADFORD, PA.

"you said this sewer would last a lifetime!"

Pity the plight of this community official. The sewer would have lasted a lifetime—if it hadn't been for H_2S, hydrogen sulphide gas, generated by sewage bacteria. H_2S causes odor nuisances and forms sulphuric acid, which has destroyed costly sewer lines in more than one California community long before the end of their normal lifetime, necessitating replacement at great expense.



You can avoid such hazards to your sewer lines and treatment plant by treating sewage with Bear Brand Chlorine, as more than a score of California communities do. Chlorination prevents formation of H_2S, and neutralizes it if already present, preventing odor nuisance and protecting sewer structures. Installation and operating costs for chlorination are low and often chlorination will save money on plant operation because of greater speed and efficiency of treatment. In the same way, it may increase plant capacity. May we send you detailed information on chlorination? Just let us know your plant capacity and method of treatment.

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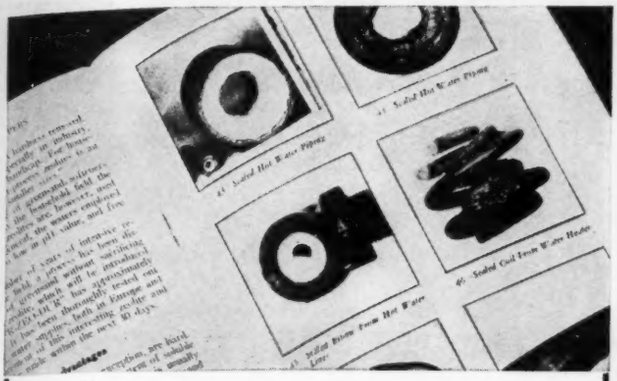

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Write for your copy today. Address The Permutit Company, 330 West 42nd Street, New York City.

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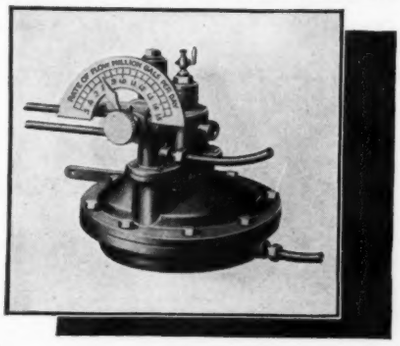
Water Conditioning Equipment

Type CD Rate of Flow Controller

The Actuator



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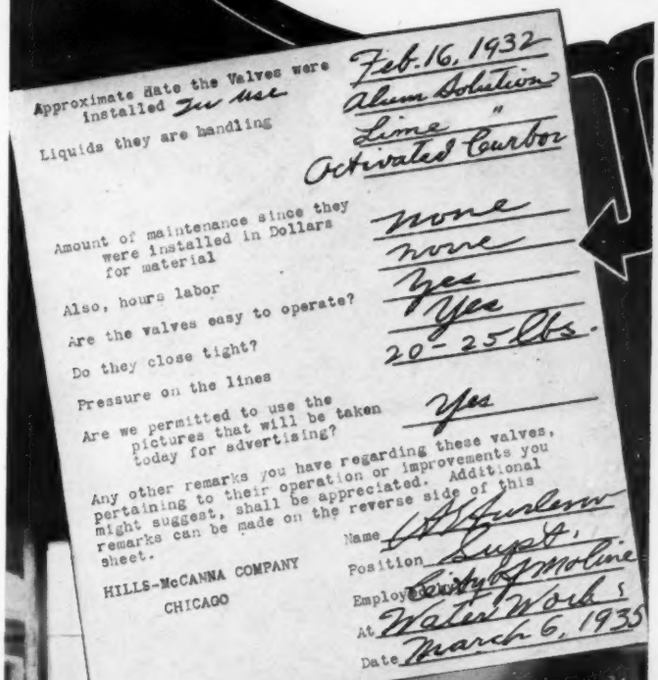
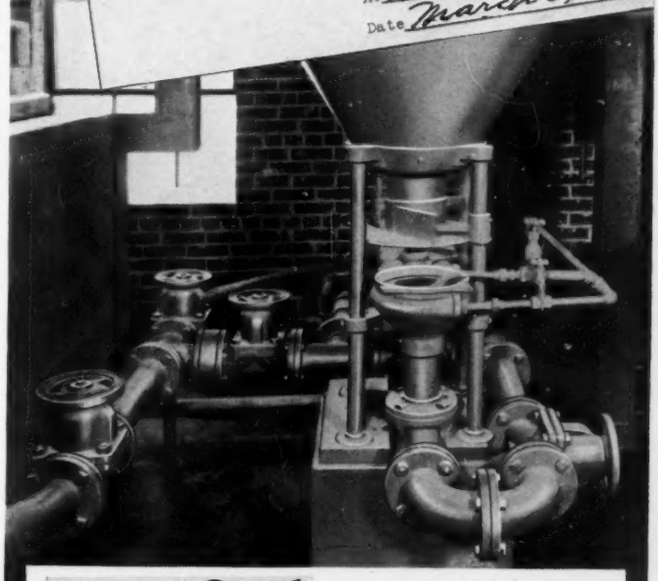
INTERNATIONAL

EVIDENCE
such as this is why many Engineers prefer HILLS-McCANNA
SAUNDERS PATENT
Valves



Approximate date the Valves were installed — Feb. 16, 1932
Liquids they are handling — Alum Solution / " / Lime / Activated Carbon
Amount of maintenance since they were installed in Dollars for material — none / none
Also, hours labor — Yes / Yes
Are the valves easy to operate? — Yes
Do they close tight? — 20-25 lbs.
Pressure on the lines
Are we permitted to use the pictures that will be taken today for advertising? — Yes
Any other remarks you have regarding these valves, pertaining to their operation or improvements you might suggest, shall be appreciated. Additional remarks can be made on the reverse side of this sheet.
HILLS-McCANNA COMPANY
CHICAGO
Name — H. H. Gunlevy
Position — Supt.
Employed by City of Moline
At — Water Works
Date — March 6, 1935



The above questionnaire indicates the performance that can be expected from Hills-McCanna "Saunders' Patent" Valves in many services. These valves are particularly well adapted for handling corrosive liquids such as are used in filtration and sewage disposal plants. They are available in sizes from one-half inch upward.

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SIMPLEX

Simplex Indicating Recording Totalizing Meter Register

Venturi Type Meters
Effluent Controllers
Filteration Plant Gauges
Water Works Specialties

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Ideal for Swimming Pools

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Because of its ability to remove coarse material such as hair and so forth from the swimming pool water, Anthrafilt is particularly well adapted to swimming pool filters.

Gives a higher percentage removed of bacteria and turbidity than sand of the same size. Low silica content is an advantage when filtering alkaline waters.

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It is not enough for your community to have just a tank, but each installation should be designed for the peculiar requirements of the individual community.

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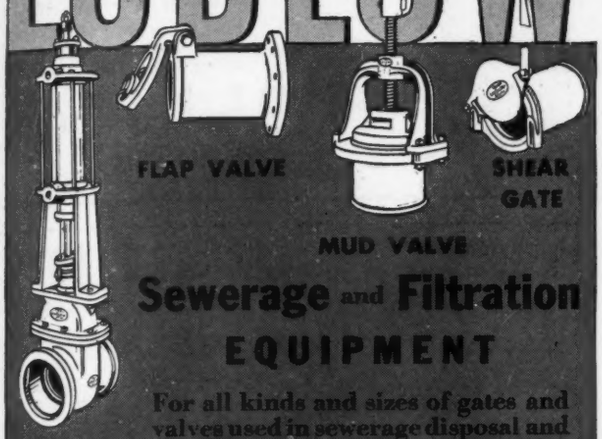

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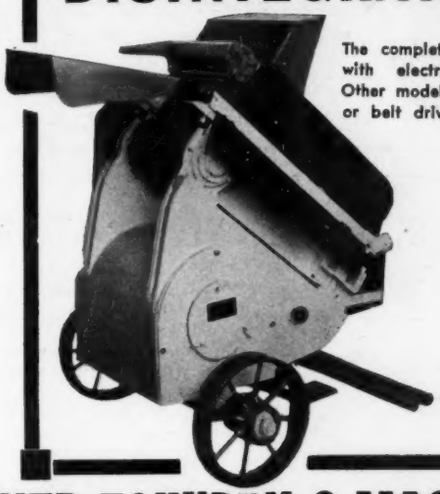
Make a **PROFIT** on your **SLUDGE** *with the* **ROYER DISINTEGRATOR**



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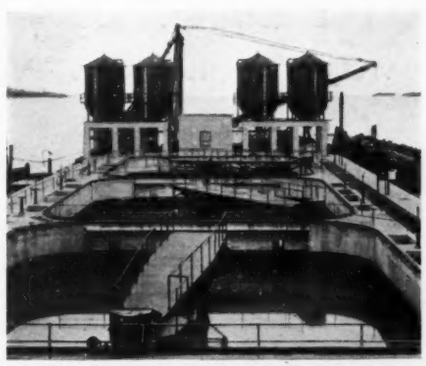

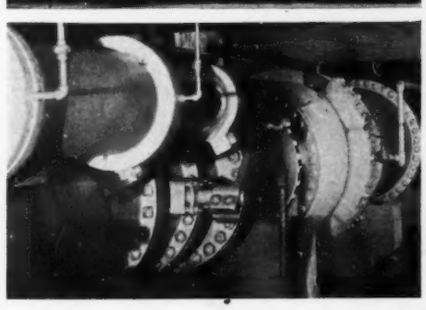

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At New Haven it was a double job, that of metering the flow of sewage and of diverting heavy storm loads past the treatment plant. (Journal of A. W. W. A. Oct., 1932, describes this equipment.)

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Similar cooperation is available for *your* flow problems, whatever their character.

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The FORD METER MITTEN provides effective insulation for basement water meters and prevents a large majority of frozen meters.

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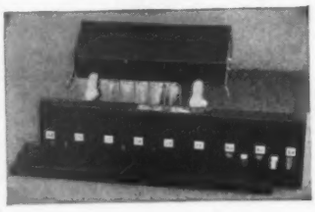

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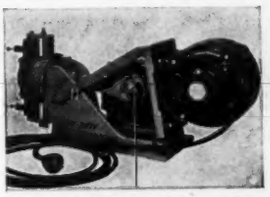

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Oct.

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Makers of Sterling Surveying Instruments.
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2 pcs.	48″	6′0″
1 pc.	48″	6′0″—Bell end.
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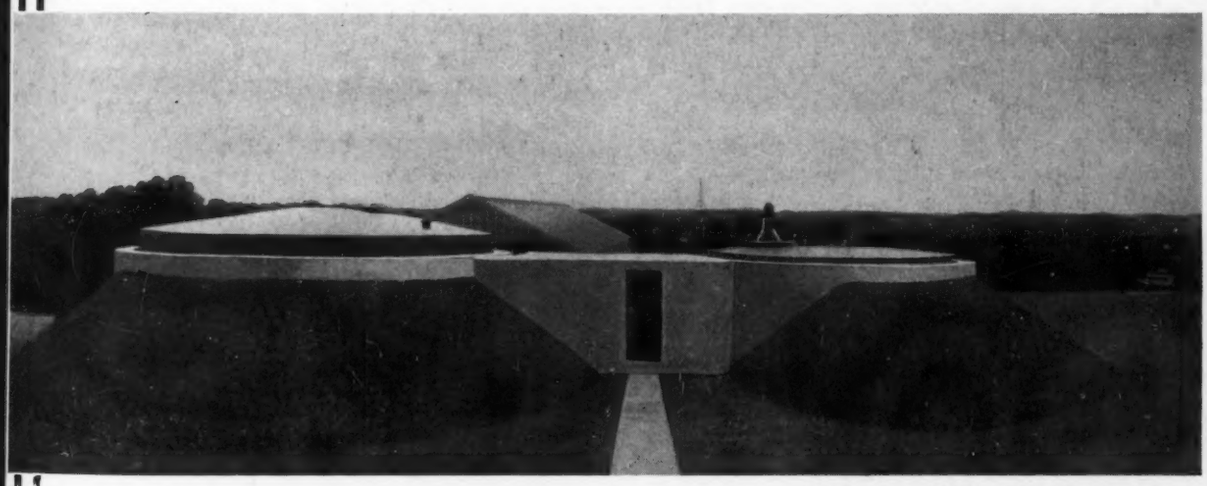

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